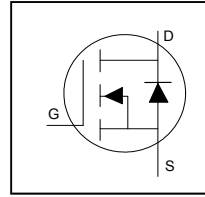


Features

- Advanced Process Technology
- Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *

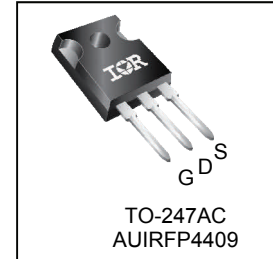


HEXFET® Power MOSFET

| | |
|--------------------------------|-------------|
| V_{DSS} | 300V |
| R_{DS(on)} typ. | 56mΩ |
| | 69mΩ |
| I_D | 38A |

Description

Specifically designed for Automotive applications, this HEXFET® Power MOSFETs utilizes the latest processing techniques to achieve low on-resistance per silicon area. This benefit combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in Automotive and a wide variety of other applications.



| | | |
|----------|----------|----------|
| G | D | S |
| Gate | Drain | Source |

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|------------------|--------------|---------------|----------|-----------------------|
| | | Form | Quantity | |
| AUIRFP4409 | TO-247AC | Tube | 25 | AUIRFP4409 |

Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature (TA) is 25°C, unless otherwise specified.

| | Parameter | Max. | Units |
|---|---|---------------------|-------|
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 38 | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 27 | |
| I _{DM} | Pulsed Drain Current ① | 152 | |
| P _D @ T _C = 25°C | Maximum Power Dissipation | 341 | W |
| | Linear Derating Factor | 2.3 | W/°C |
| V _{GS} | Gate-to-Source Voltage | ± 20 | V |
| E _{AS} (Thermally limited) | Single Pulse Avalanche Energy ② | 541 | mJ |
| T _J T _{STG} | Operating Junction and Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |
| | Mounting Torque, 6-32 or M3 Screw | 10 lbf·in (1.1 N·m) | |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|------------------|------------------------------------|------|------|-------|
| R _{θJC} | Junction-to-Case ③ | — | 0.44 | °C/W |
| R _{θCS} | Case-to-Sink, Flat Greased Surface | 0.24 | — | |
| R _{θJA} | Junction-to-Ambient ④ | — | 40 | |

HEXFET® is a registered trademark of Infineon.

*Qualification standards can be found at www.infineon.com

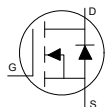
Static @ T_J = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--|--------------------------------------|------|------|------|-------|--|
| V _{(BR)DSS} | Drain-to-Source Breakdown Voltage | 300 | — | — | V | V _{GS} = 0V, I _D = 250μA |
| ΔV _{(BR)DSS} /ΔT _J | Breakdown Voltage Temp. Coefficient | — | 0.24 | — | V/°C | Reference to 25°C, I _D = 3.5mA |
| R _{DS(on)} | Static Drain-to-Source On-Resistance | — | 56 | 69 | mΩ | V _{GS} = 10V, I _D = 24A ④ |
| V _{GS(th)} | Gate Threshold Voltage | 3.0 | — | 5.0 | V | V _{DS} = V _{GS} , I _D = 250μA |
| I _{DSS} | Drain-to-Source Leakage Current | — | — | 20 | μA | V _{DS} = 300V, V _{GS} = 0V |
| | | — | — | 250 | | V _{DS} = 300V, V _{GS} = 0V, T _J = 125°C |
| I _{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | V _{GS} = 20V |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | V _{GS} = -20V |
| R _G | Gate Resistance | — | 1.3 | — | Ω | |

Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

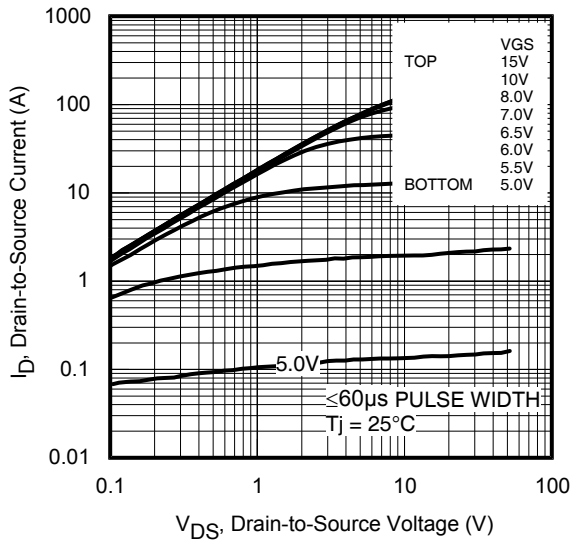
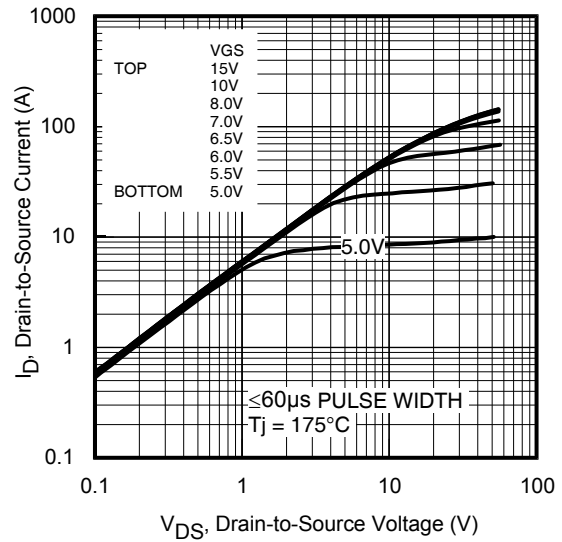
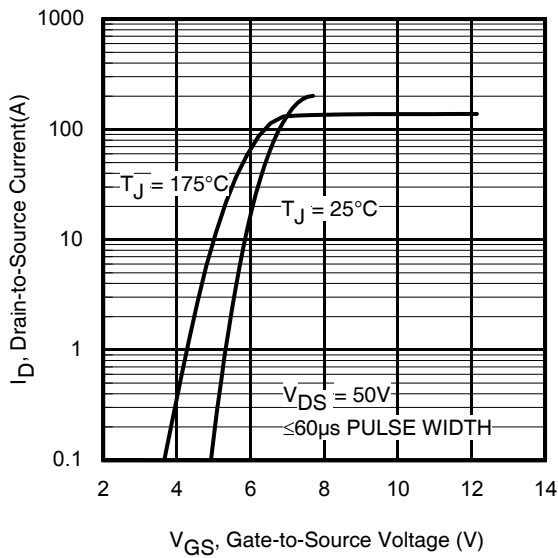
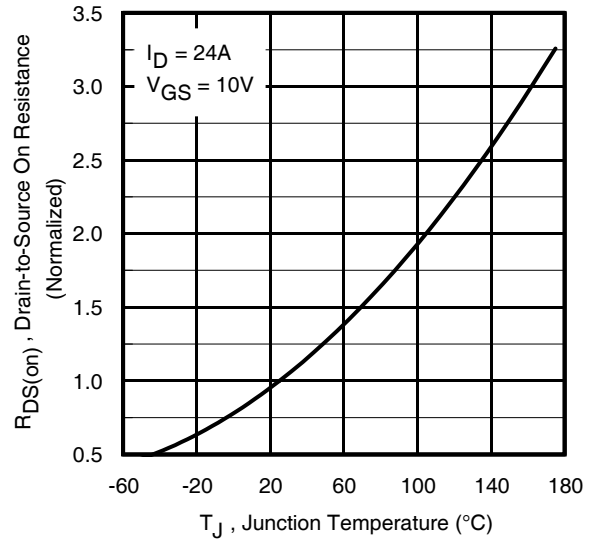
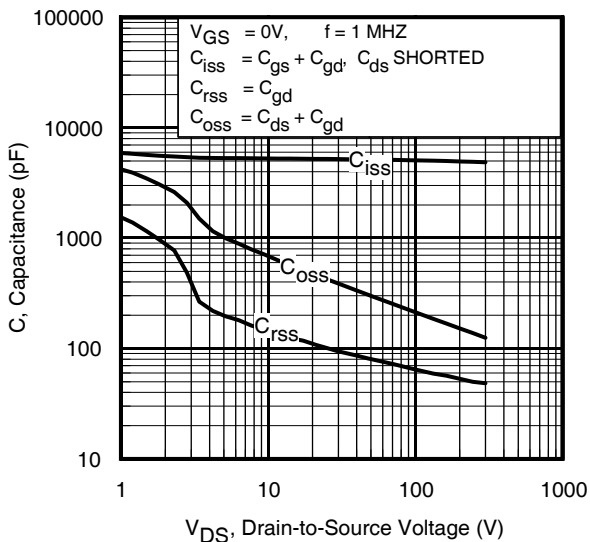
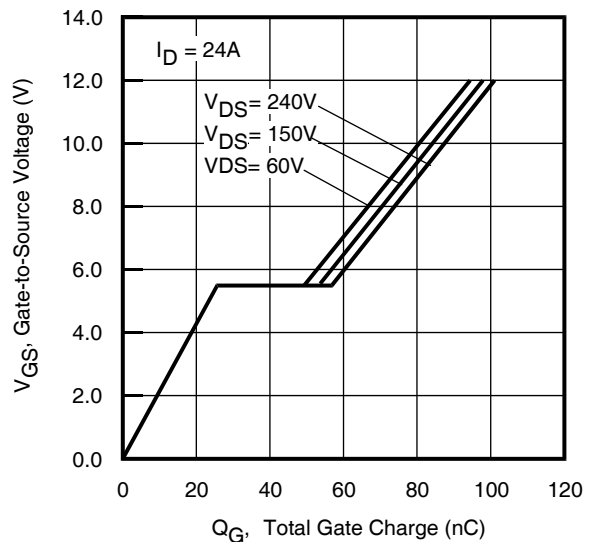
| | | | | | | |
|---------------------------|---|----|------|-----|----|---|
| g _{fs} | Forward Transconductance | 45 | — | — | S | V _{DS} = 50V, I _D = 24A |
| Q _g | Total Gate Charge | — | 83 | 125 | nC | I _D = 24A |
| Q _{gs} | Gate-to-Source Charge | — | 28 | 42 | | V _{DS} = 150V |
| Q _{gd} | Gate-to-Drain Charge | — | 26 | 39 | | V _{GS} = 10V |
| t _{d(on)} | Turn-On Delay Time | — | 18 | — | ns | V _{DD} = 195V |
| t _r | Rise Time | — | 23 | — | | I _D = 24A |
| t _{d(off)} | Turn-Off Delay Time | — | 34 | — | | R _G = 2.2Ω |
| t _f | Fall Time | — | 20 | — | | V _{GS} = 10V |
| C _{iss} | Input Capacitance | — | 5168 | — | pF | V _{GS} = 0V |
| C _{oss} | Output Capacitance | — | 300 | — | | V _{DS} = 50V |
| C _{rss} | Reverse Transfer Capacitance | — | 77 | — | | f = 1.0MHz |
| C _{oss eff.(ER)} | Effective Output Capacitance (Energy Related) | — | 196 | — | | V _{GS} = 0V, V _{DS} = 0V to 240V ^⑥ |
| C _{oss eff.(TR)} | Output Capacitance (Time Related) | — | 265 | — | | See Fig.11 |
| | | | | | | V _{GS} = 0V, V _{DS} = 0V to 240V ^⑤ |

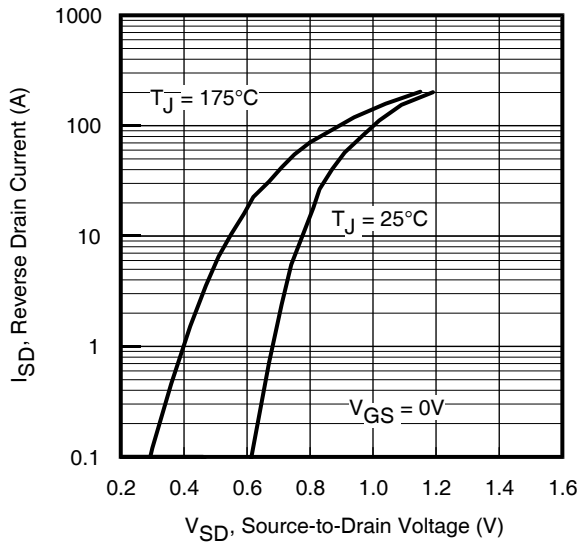
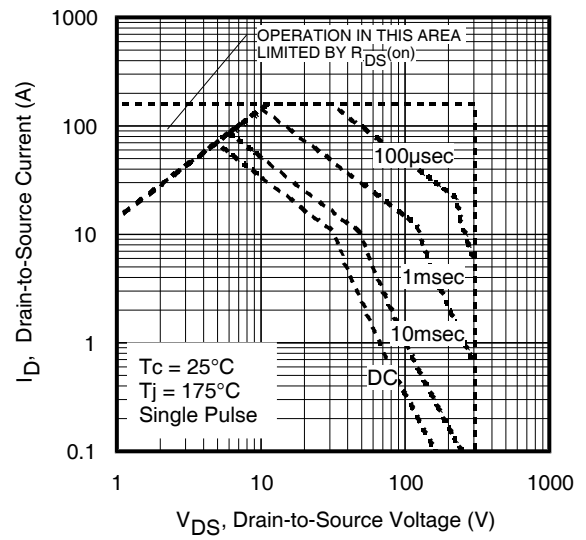
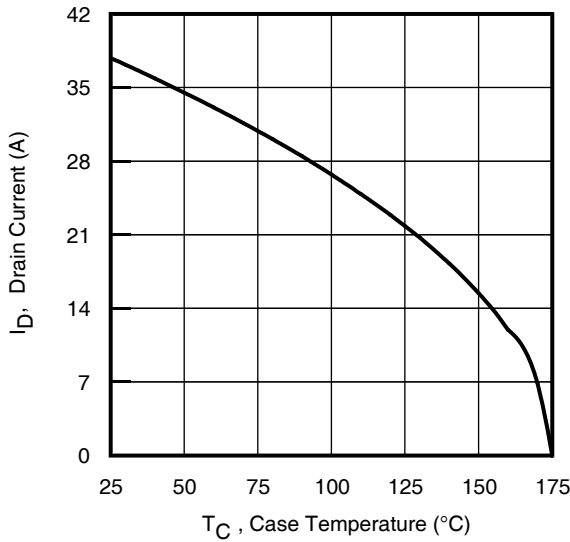
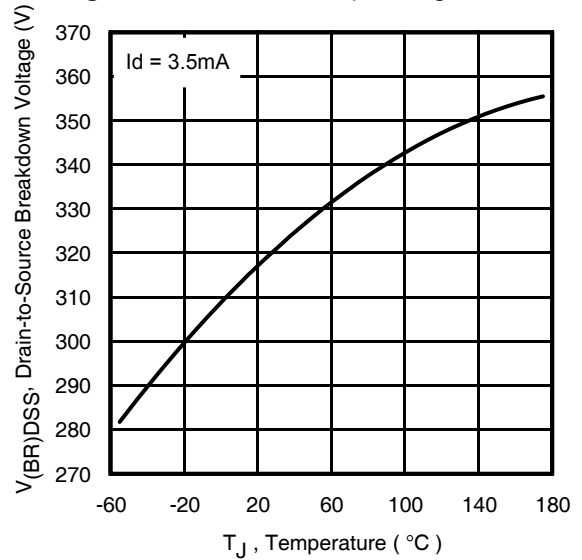
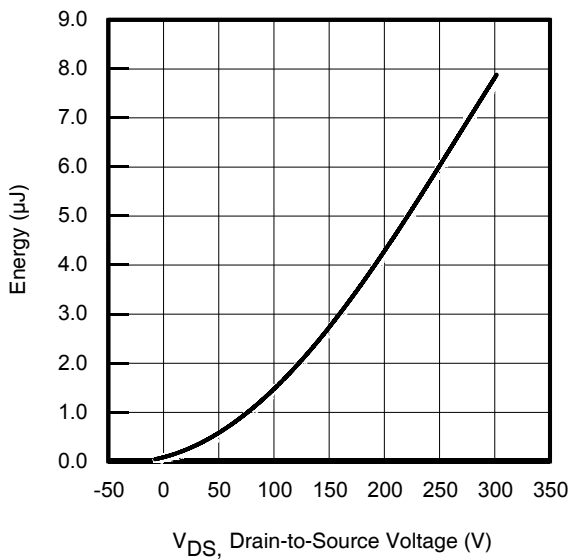
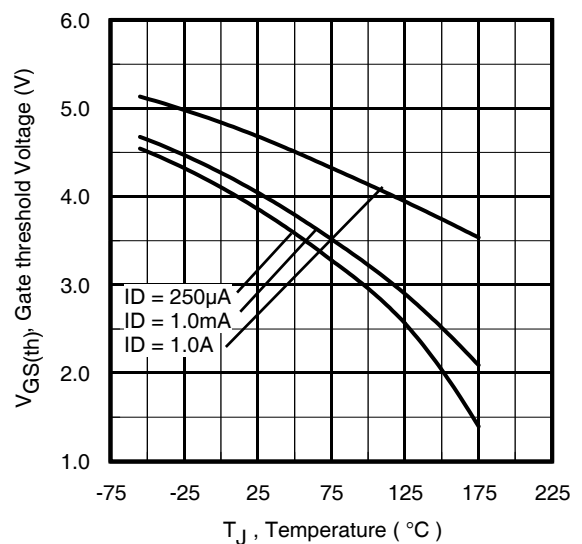
Diode Characteristics

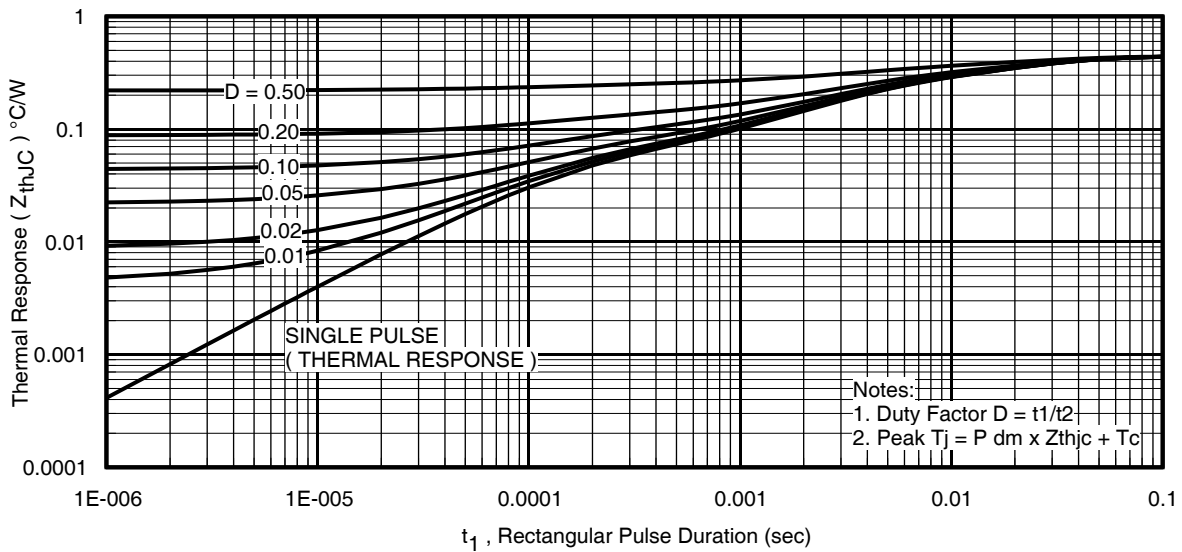
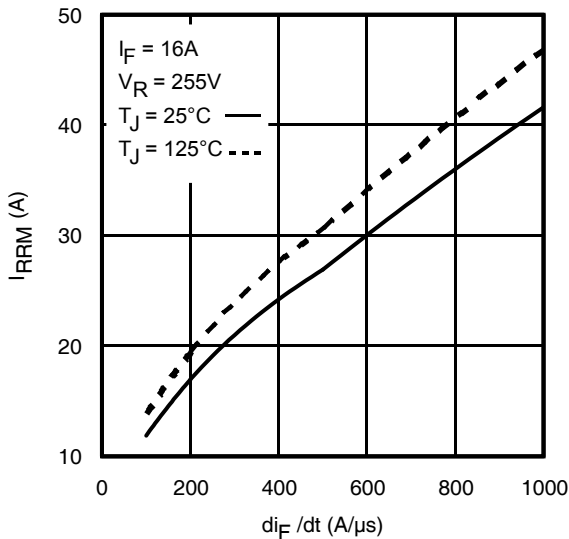
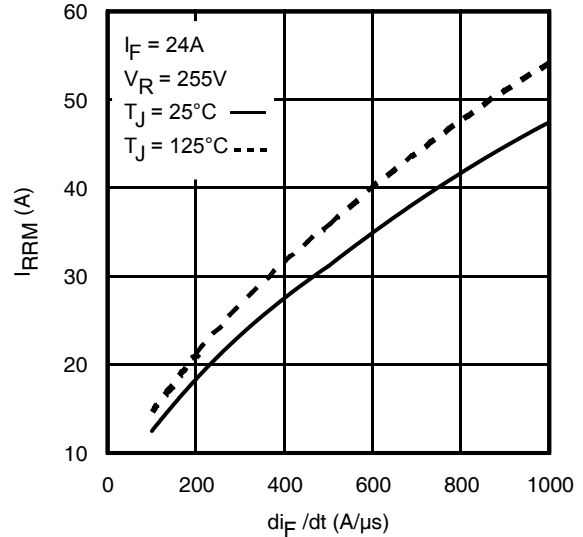
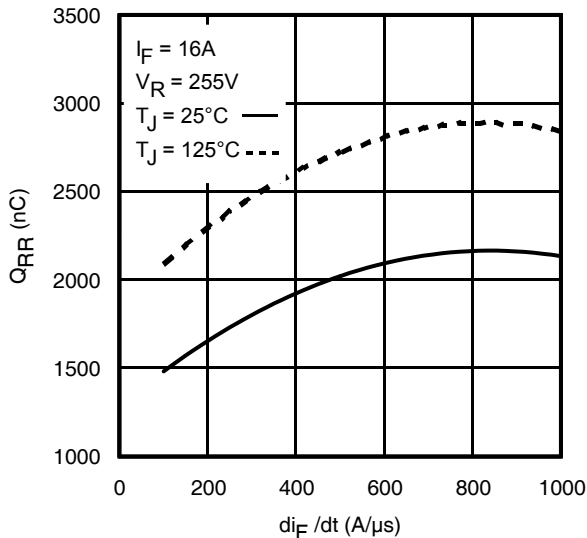
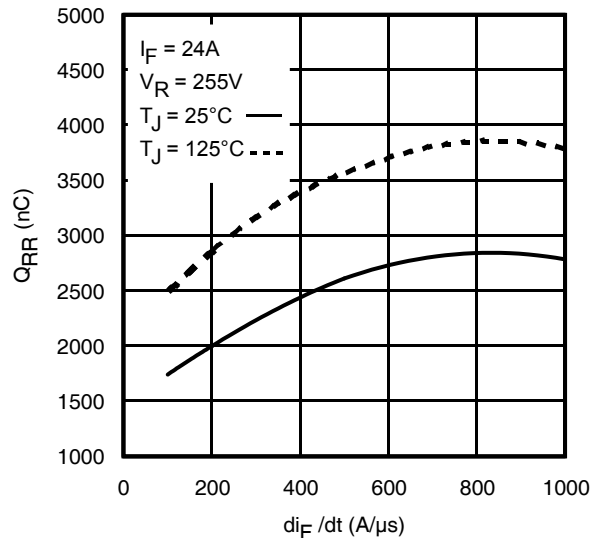
| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|------------------|---|------|------|------|-------|--|
| I _S | Continuous Source Current (Body Diode)① | — | — | 40 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 160 | | |
| V _{SD} | Diode Forward Voltage | — | — | 1.3 | V | T _J = 25°C, I _S = 24A, V _{GS} = 0V ④ |
| t _{rr} | Reverse Recovery Time | — | 302 | — | ns | T _J = 25°C V _{DD} = 255V |
| | | — | 379 | — | | T _J = 125°C I _F = 24A, |
| Q _{rr} | Reverse Recovery Charge | — | 1739 | — | nC | T _J = 25°C di/dt = 100A/μs ④ |
| | | — | 2497 | — | | T _J = 125°C |
| I _{RSM} | Reverse Recovery Current | — | 13 | — | A | T _J = 25°C |

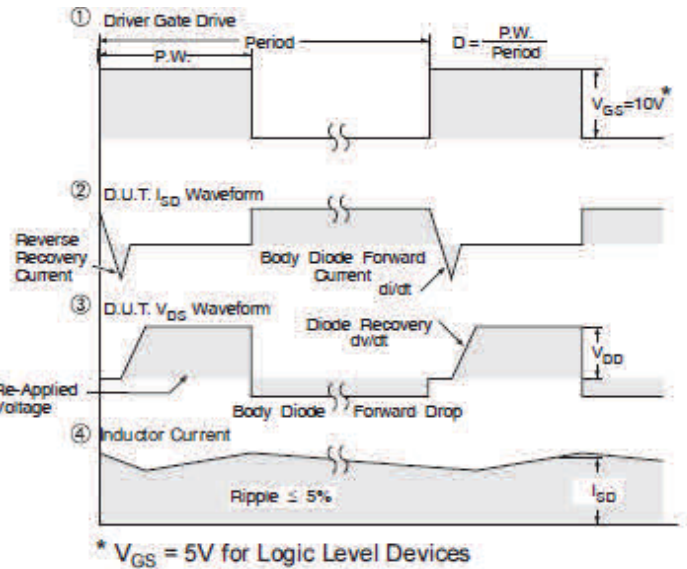
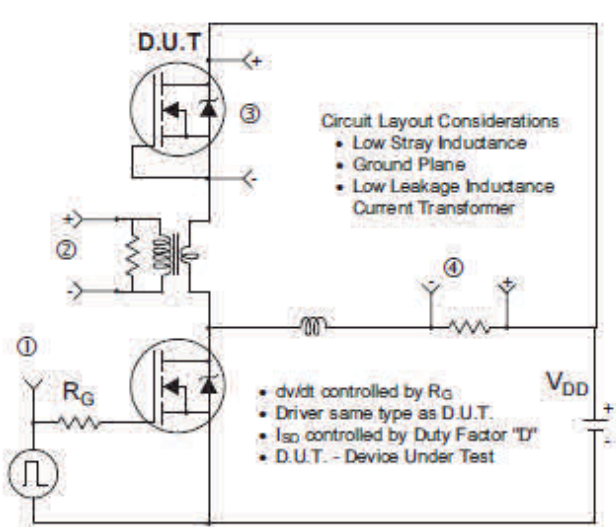
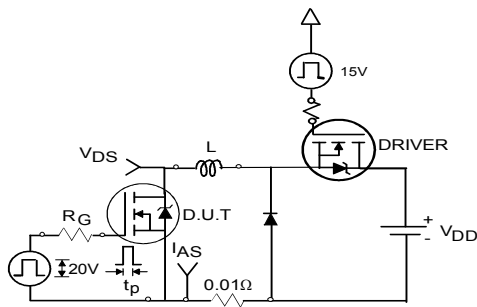
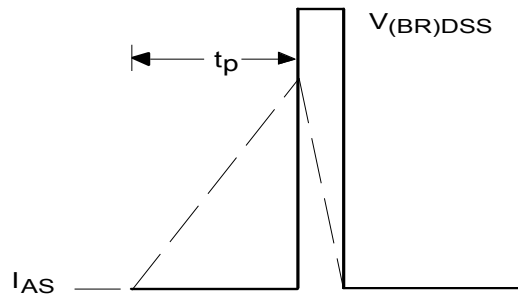
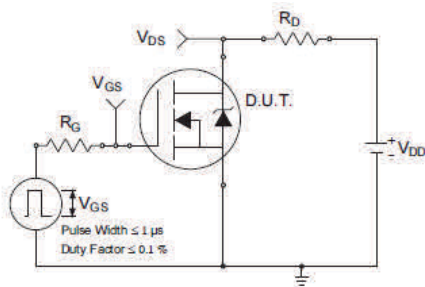
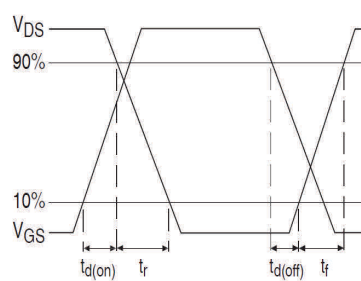
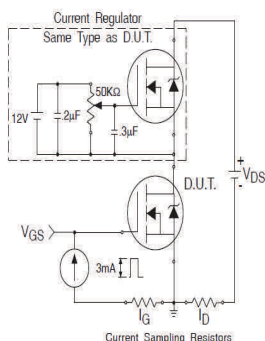
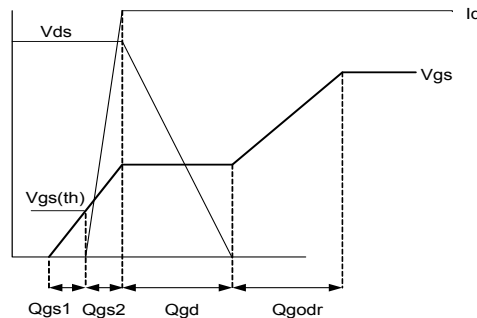
Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Recommended max EAS limit, starting T_J = 25°C, L = 2.05mH, R_G = 50Ω, I_{AS} = 24A, V_{GS} = 10V.
- ③ I_{SD} ≤ 24A, di/dt ≤ 1771A/μs, V_{DD} ≤ V_{(BR)DSS}, T_J ≤ 175°C.
- ④ Pulse width ≤ 400μs; duty cycle ≤ 2%.
- ⑤ C_{oss eff. (TR)} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- ⑥ C_{oss eff. (ER)} is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
- ⑦ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994 http://www.irf.com/technical-info/app_notes/an-994.pdf
- ⑧ R_θ is measured at T_J approximately 90°C


Fig 1. Typical Output Characteristics

Fig 2. Typical Output Characteristics

Fig 3. Typical Transfer Characteristics

Fig 4. Normalized On-Resistance vs. Temperature

Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage

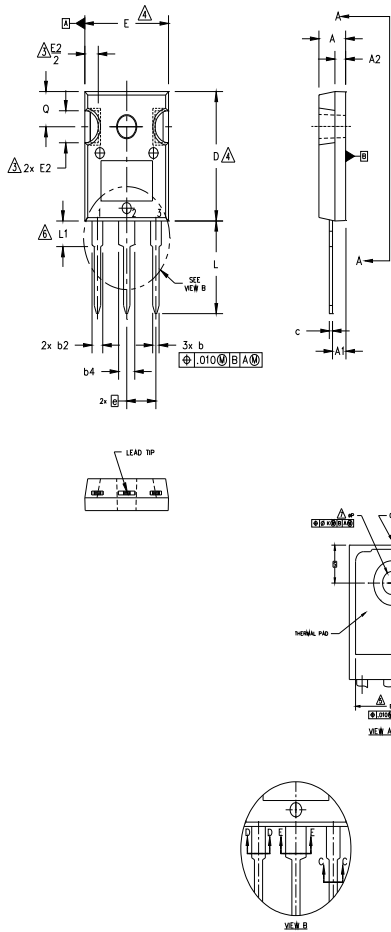

Fig 7. Typical Source-Drain Diode Forward Voltage

Fig 8. Maximum Safe Operating Area

Fig 9. Maximum Drain Current vs. Case Temperature

Fig 10. Drain-to-Source Breakdown Voltage

Fig 11. Typical C_{oss} Stored Energy

Fig 12. Threshold Voltage vs. Temperature


Fig 13. Maximum Effective Transient Thermal Impedance, Junction-to-Case

Fig 14. Typical Recovery Current vs. di_F/dt

Fig 15. Typical Recovery Current vs. di_F/dt

Fig 16. Typical Stored Charge vs. di_F/dt

Fig 17. Typical Stored Charge vs. di_F/dt


Fig 18. Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

Fig 19a. Unclamped Inductive Test Circuit

Fig 19b. Unclamped Inductive Waveforms

Fig 20a. Switching Time Test Circuit

Fig 20b. Switching Time Waveforms

Fig 21a. Gate Charge Test Circuit

Fig 21b. Gate Charge Waveform

TO-247AC Package Outline

Dimensions are shown in millimeters (inches)


NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. ØP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AC .

| SYMBOL | DIMENSIONS | | | | NOTES |
|--------|------------|------|-------------|-------|-------|
| | INCHES | | MILLIMETERS | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | .183 | .209 | 4.65 | 5.31 | |
| A1 | .087 | .102 | 2.21 | 2.59 | |
| A2 | .059 | .098 | 1.50 | 2.49 | |
| b | .039 | .055 | 0.99 | 1.40 | |
| b1 | .039 | .053 | 0.99 | 1.35 | |
| b2 | .065 | .094 | 1.65 | 2.39 | |
| b3 | .065 | .092 | 1.65 | 2.34 | |
| b4 | .102 | .135 | 2.59 | 3.43 | |
| b5 | .102 | .133 | 2.59 | 3.38 | |
| c | .015 | .035 | 0.38 | 0.89 | |
| c1 | .015 | .033 | 0.38 | 0.84 | |
| D | .776 | .815 | 19.71 | 20.70 | 4 |
| D1 | .515 | - | 13.08 | - | 5 |
| D2 | .020 | .053 | 0.51 | 1.35 | |
| E | .602 | .625 | 15.29 | 15.87 | 4 |
| E1 | .530 | - | 13.46 | - | |
| E2 | .178 | .216 | 4.52 | 5.49 | |
| e | .215 BSC | | 5.46 BSC | | |
| Øk | .010 | | 0.25 | | |
| L | .559 | .634 | 14.20 | 16.10 | |
| L1 | .146 | .169 | 3.71 | 4.29 | |
| ØP | .140 | .144 | 3.56 | 3.66 | |
| ØP1 | - | .291 | - | 7.39 | |
| Q | .209 | .224 | 5.31 | 5.69 | |
| S | .217 BSC | | 5.51 BSC | | |

LEAD ASSIGNMENTS
HEXFEEET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

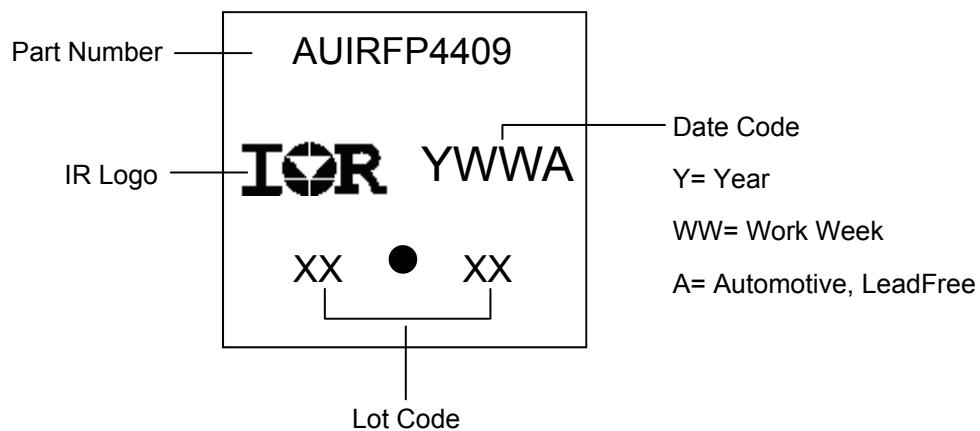
IGBTs, CoPACK

- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER
- 4.- COLLECTOR

DIODES

- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

TO-247AC Part Marking Information



TO-247AC package is not recommended for Surface Mount Application.

Qualification Information

| | | | |
|----------------------------|-----------------------------------|---|-----|
| Qualification Level | | Automotive (per AEC-Q101) | |
| | | Comments: This part number(s) passed Automotive qualification. Infineon's Industrial and Consumer qualification level is granted by extension of the higher Automotive level. | |
| ESD | Moisture Sensitivity Level | TO-247AC | N/A |
| | Machine Model | Class M4 (+/- 500V) [†] AEC-Q101-002 | |
| | Human Body Model | Class H2 (+/- 4000V) [†] AEC-Q101-001 | |
| | Charged Device Model | Class C5 (+/- 2000) [†] AEC-Q101-005 | |
| RoHS Compliant | | Yes | |

† Highest passing voltage.

Revision History

| Date | Comments |
|-----------|--|
| 9/21/2017 | <ul style="list-style-type: none"> Updated datasheet with corporate template Corrected typo error on package outline and part marking on page 7. |

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[NTE2967](#) [NTE2969](#) [NTE2976](#) [NTE6400A](#) [NTE2910](#) [NTE2916](#) [NTE2956](#) [NTE2911](#) [DMN2080UCB4-7](#) [TK10A80W,S4X\(S](#)
[SSM6P69NU,LF](#) [DMP22D4UFO-7B](#) [DMN1006UCA6-7](#)