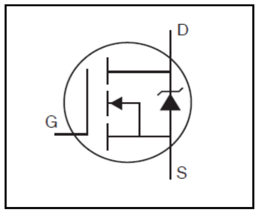
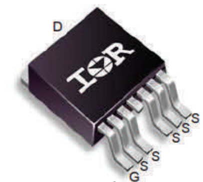
**AUTOMOTIVE GRADE**

# AUIRF3805S-7P
# AUIRF3805L-7P

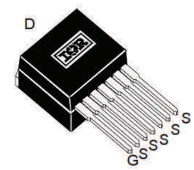
## Features
- Advanced Process Technology
- Ultra Low On-Resistance
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free, RoHS Compliant
- Automotive Qualified *




| | | |
|---|---|---|
| $V_{DSS}$ | | 55V |
| $R_{DS(on)}$ | typ. | 2.0mΩ |
| | max. | 2.6mΩ ⑦ |
| $I_D$ | | 240A |



$D^2$Pak 7 Pin
AUIRF3805S-7P



TO-263CA 7 Pin
AUIRF3805L-7P

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

## Description
Specifically designed for Automotive applications, this HEXFET® Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 175°C junction operating temperature, fast switching speed and improved repetitive avalanche rating. These features combine to make this design an extremely efficient and reliable device for use in Automotive applications and wide variety of other applications.

| Base Part Number | Package Type | Standard Pack | | Complete Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| AUIRF3805L-7P | TO-263-7PIN | Tube | 50 | AUIRF3805L-7P |
| AUIRF3805S-7P | $D^2$Pak-7PIN | Tube | 50 | AUIRF3805S-7P |
| | | Tape and Reel Left | 800 | AUIRF3805S-7TRL |

## 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.

| Symbol | Parameter | Max. | Units |
|---|---|---|---|
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V | 240 | A |
| $I_D$ @ $T_C$ = 100°C | Continuous Drain Current, $V_{GS}$ @ 10V | 170 | |
| $I_D$ @ $T_C$ = 25°C | Continuous Drain Current, $V_{GS}$ @ 10V (Package Limited) | 160 | |
| $I_{DM}$ | Pulsed Drain Current ① | 1000 | |
| $P_D$ @$T_C$ = 25°C | Maximum Power Dissipation | 300 | W |
| | Linear Derating Factor | 2.0 | W/°C |
| $V_{GS}$ | Gate-to-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy (Thermally Limited) ⑧ | 440 | mJ |
| $E_{AS\ (tested)}$ | Single Pulse Avalanche Energy Tested Value ② | 680 | |
| $I_{AR}$ | Avalanche Current ① | See Fig.12a,12b,15,16 | A |
| $E_{AR}$ | Repetitive Avalanche Energy ① | | mJ |
| dv/dt | Peak Diode Recovery ③ | 2.3 | V/ns |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 175 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |

## Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case ⑥ | —— | 0.50 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | —— | |
| $R_{\theta JA}$ | Junction-to-Ambient | —— | 62 | |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount, steady state) ⑤ | —— | 40 | |

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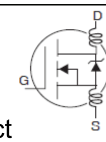
*Qualification standards can be found at www.infineon.com

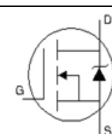
### Static Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 55 | —— | —— | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | —— | 0.05 | —— | V/°C | Reference to 25°C, $I_D$ = 1.0mA |
| $R_{DS(on)}$ SMD | Static Drain-to-Source On-Resistance | —— | 2.0 | 2.6 | mΩ | $V_{GS}$ = 10V, $I_D$ = 140A ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | —— | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| gfs | Forward Transconductance | 110 | —— | —— | S | $V_{DS}$ = 25V, $I_D$ = 140A |
| $I_{DSS}$ | Drain-to-Source Leakage Current | —— | —— | 20 | μA | $V_{DS}$ = 55V, $V_{GS}$ = 0V |
| | | —— | —— | 250 | | $V_{DS}$ = 55V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate-to-Source Forward Leakage | —— | —— | 200 | nA | $V_{GS}$ = 20V |
| | Gate-to-Source Reverse Leakage | —— | —— | -200 | | $V_{GS}$ = -20V |

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

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge | —— | 130 | 200 | nC | $I_D$ = 140A |
| $Q_{gs}$ | Gate-to-Source Charge | —— | 53 | —— | | $V_{DS}$ = 44V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | —— | 49 | —— | | $V_{GS}$ = 10V ③ |
| $t_{d(on)}$ | Turn-On Delay Time | —— | 23 | —— | ns | $V_{DD}$ = 28V |
| $t_r$ | Rise Time | —— | 130 | —— | | $I_D$ = 140A |
| $t_{d(off)}$ | Turn-Off Delay Time | —— | 80 | —— | | $R_G$ = 2.4Ω |
| $t_f$ | Fall Time | —— | 52 | —— | | $V_{GS}$ = 10V ③ |
| $L_D$ | Internal Drain Inductance | —— | 4.5 | —— | nH | Between lead, 6mm (0.25in.) from package and center of die contact  |
| $L_S$ | Internal Source Inductance | —— | 7.5 | —— | | |
| $C_{iss}$ | Input Capacitance | —— | 7820 | —— | pF | $V_{GS}$ = 0V |
| $C_{oss}$ | Output Capacitance | —— | 1260 | —— | | $V_{DS}$ = 25V |
| $C_{rss}$ | Reverse Transfer Capacitance | —— | 610 | —— | | $f$ = 1.0 MHz, See Fig. 5 |
| $C_{oss}$ | Output Capacitance | —— | 4310 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 1.0V, $f$ = 1.0MHz |
| $C_{oss}$ | Output Capacitance | | 980 | | | $V_{GS}$ = 0V, $V_{DS}$ = 44V, $f$ = 1.0MHz |
| $C_{oss}$ eff. | Effective Output Capacitance ④ | —— | 1540 | —— | | $V_{GS}$ = 0V, $V_{DS}$ = 0V to 44V |

### Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current (Body Diode) | —— | —— | 240 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ② | —— | —— | 1000 | | |
| $V_{SD}$ | Diode Forward Voltage | —— | —— | 1.3 | V | $T_J$ = 25°C, $I_S$ = 140A, $V_{GS}$ = 0V ③ |
| $t_{rr}$ | Reverse Recovery Time | —— | 45 | 68 | ns | $T_J$ = 25°C, $I_F$ = 140A, $V_{DD}$ = 28V |
| $Q_{rr}$ | Reverse Recovery Charge | —— | 35 | 53 | nC | di/dt = 100A/μs ③ |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$+$L_D$) | | | | |

**Notes:**

① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).

② This value determined from sample failure population starting $T_J$ = 25°C, L=0.043mH, $R_G$ = 25Ω, $I_{AS}$ = 140A, $V_{GS}$ =10V.

③ Pulse width ≤ 1.0ms; duty cycle ≤ 2%.

④ Coss eff. is a fixed capacitance that gives the same charging time as Coss while $V_{DS}$ is rising from 0 to 80% $V_{DSS}$.

⑤ This is applied to $D^2$Pak, when mounted on 1" square PCB ( FR-4 or G-10 Material ). For recommended footprint and soldering techniques refer to application note #AN-994.

⑥ $R_\theta$ is measured at $T_J$ of approximately 90°C.

⑦ Solder mounted on IMS substrate.

⑧ Limited by $T_{Jmax}$ starting $T_J$ = 25°C, L=0.043mH, $R_G$ = 25Ω, $I_{AS}$ = 140A, $V_{GS}$ =10V.Part not recommended for use above this value.

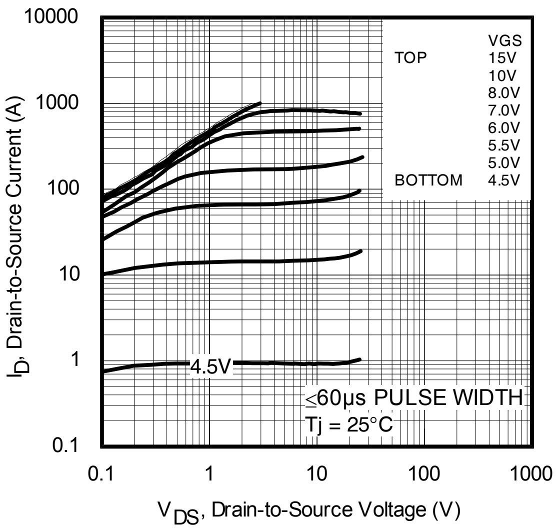



**Fig. 1** Typical Output Characteristics

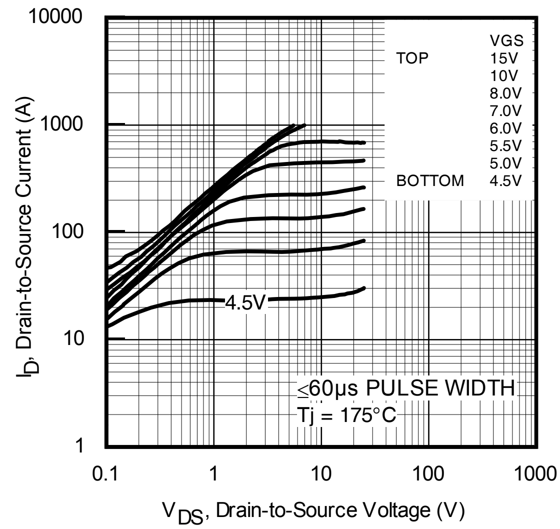



**Fig. 2** Typical Output Characteristics

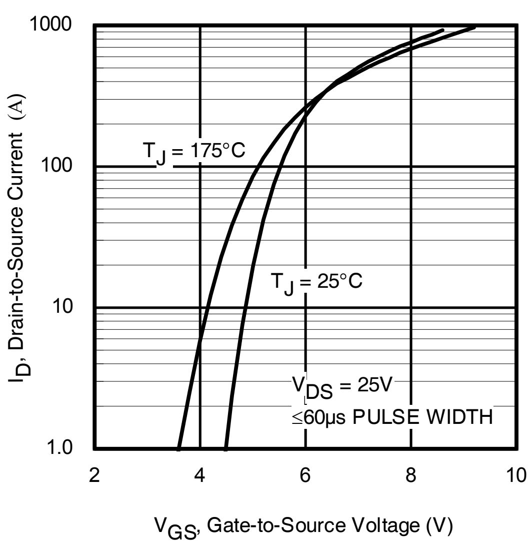



**Fig. 3** Typical Transfer Characteristics

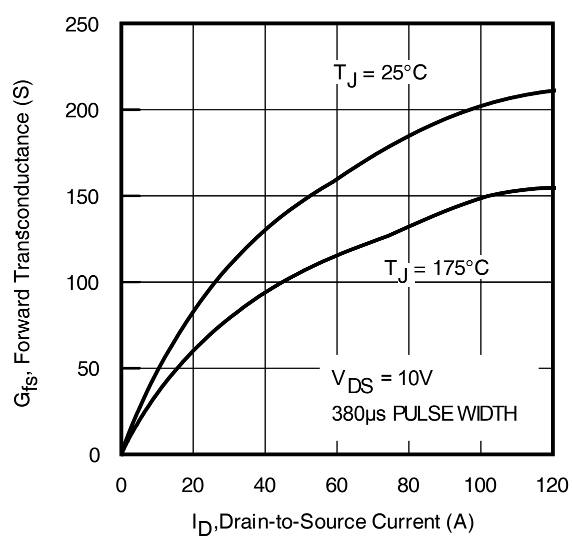



**Fig. 4** Typical Forward Transconductance vs. Drain Current

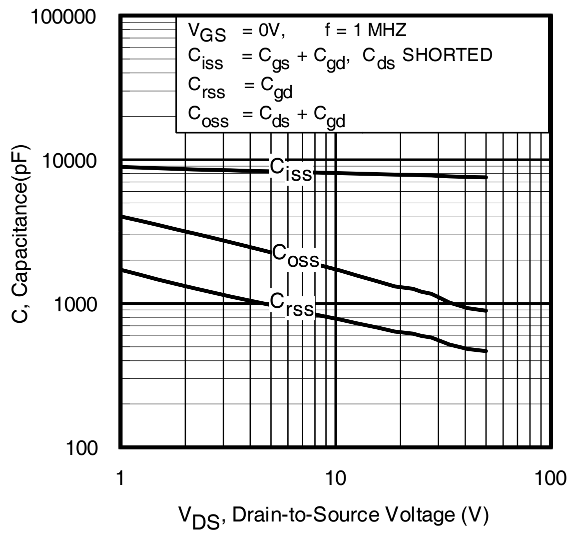



**Fig 5.** Typical Capacitance vs. Drain-to-Source Voltage

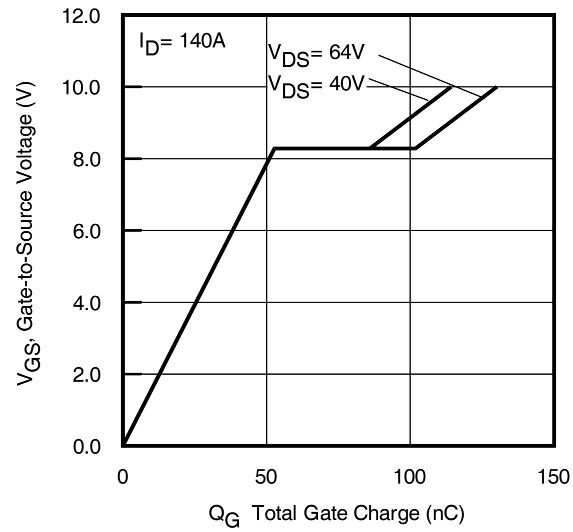



**Fig 6.** Typical Gate Charge vs. Gate-to-Source Voltage

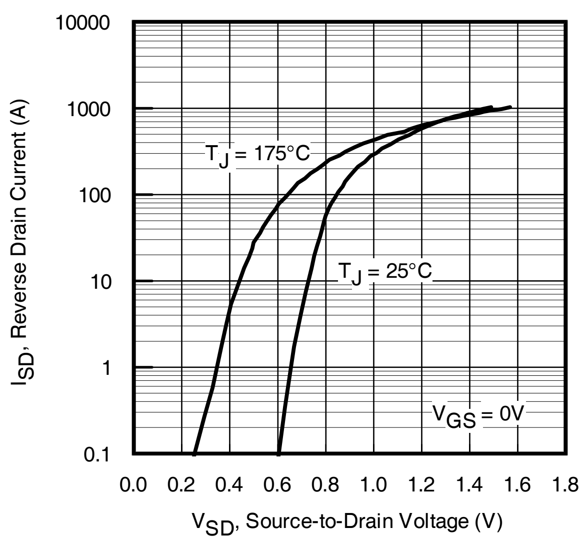



**Fig. 7** Typical Source-to-Drain Diode Forward Voltage

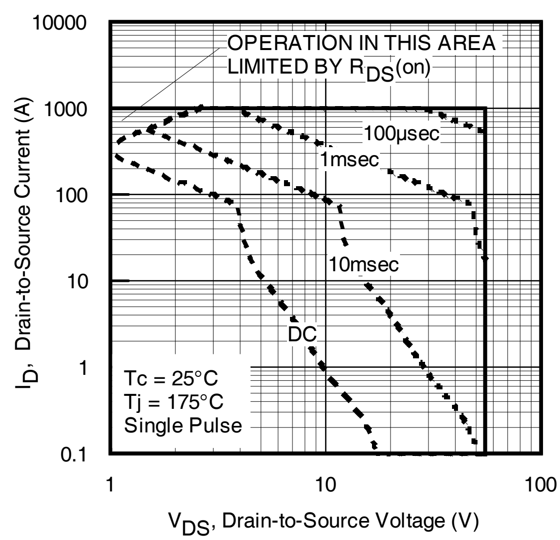



**Fig 8.** Maximum Safe Operating Area

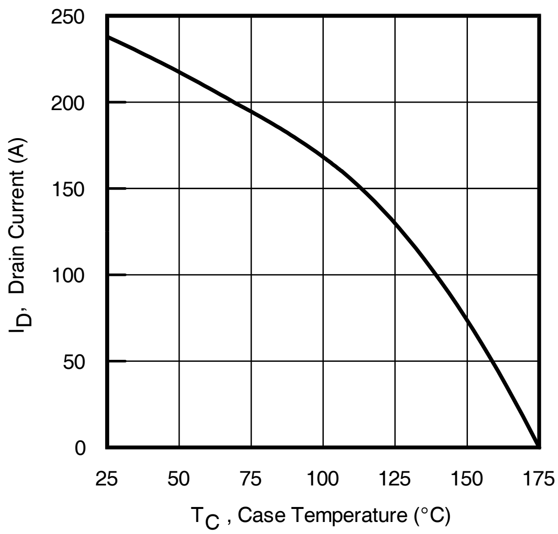



**Fig 9.** Maximum Drain Current vs. Case Temperature

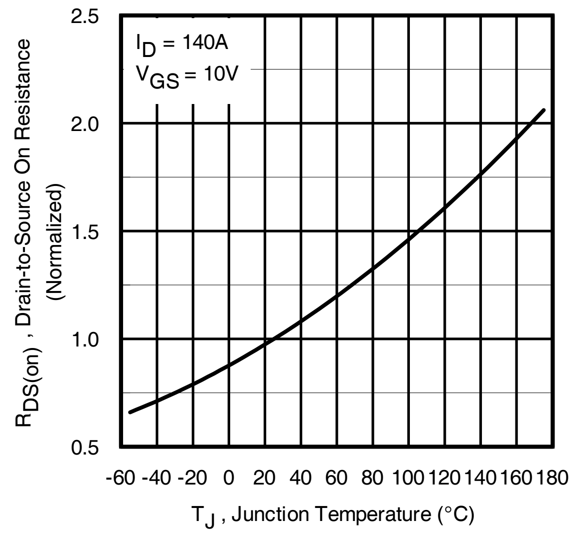
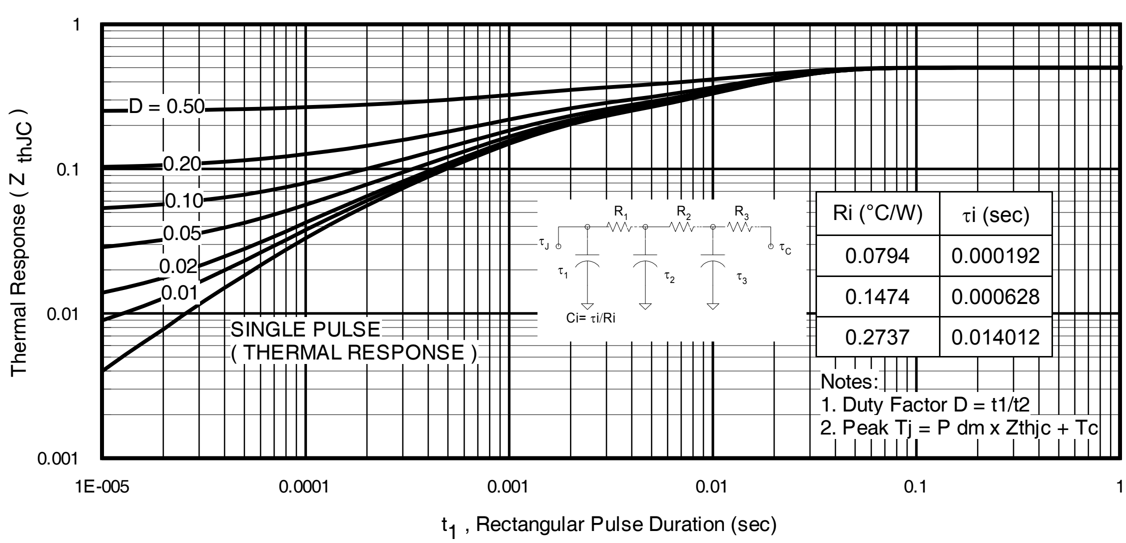



**Fig 10.** Normalized On-Resistance vs. Temperature




| Ri (°C/W) | τi (sec) |
|---|---|
| 0.0794 | 0.000192 |
| 0.1474 | 0.000628 |
| 0.2737 | 0.014012 |

**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

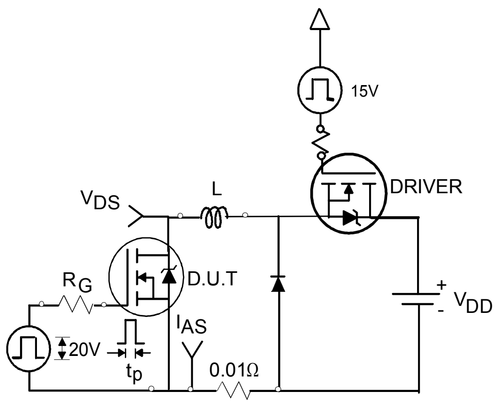



**Fig 12a.** Unclamped Inductive Test Circuit

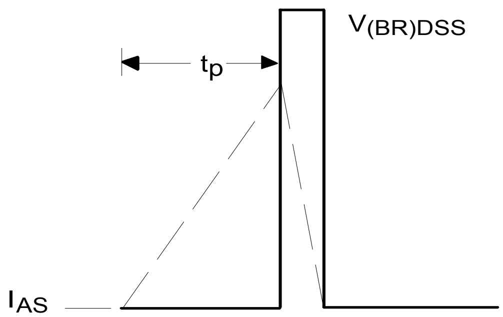



**Fig 12b.** Unclamped Inductive Waveforms

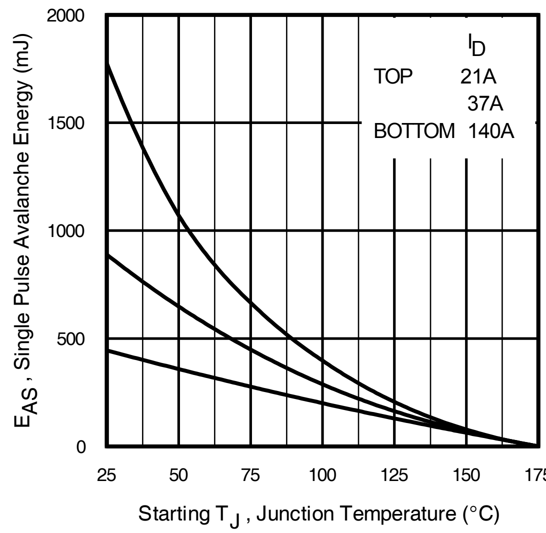



**Fig 12c.** Maximum Avalanche Energy

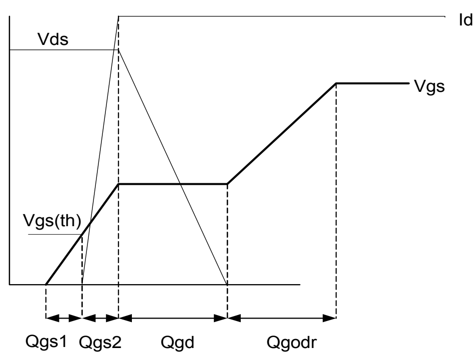



**Fig 13a.** Basic Gate Charge Waveform

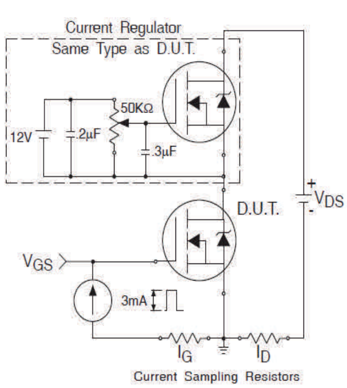



**Fig 13b.** Gate Charge Test Circuit

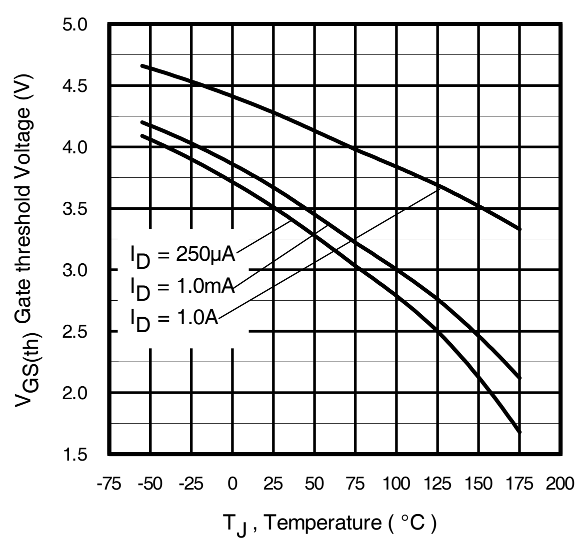



**Fig 14.** Threshold Voltage vs. Temperature

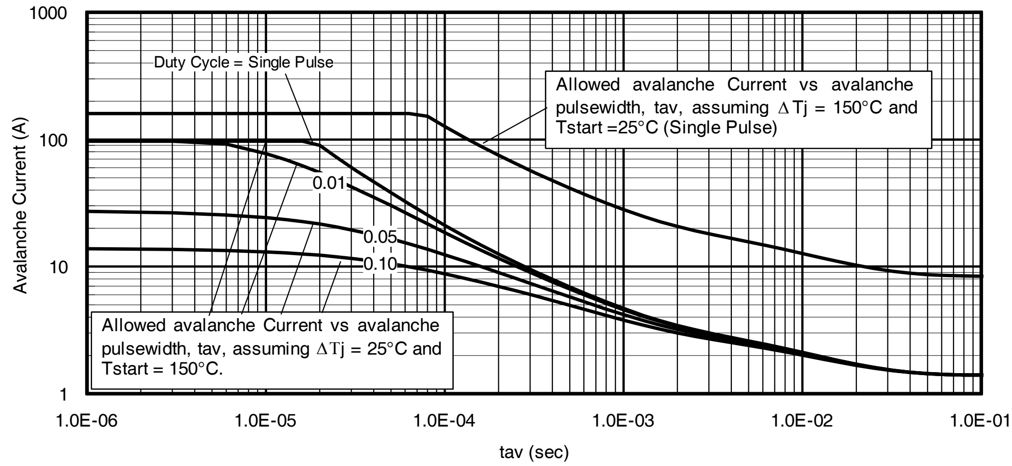



**Fig 15.** Typical Avalanche Current vs. Pulse width

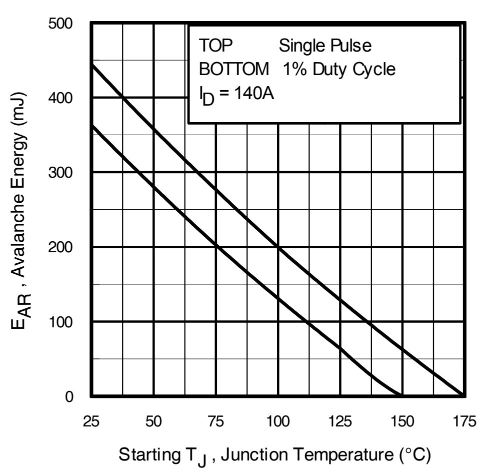



**Fig 16.** Maximum Avalanche Energy vs. Temperature

**Notes on Repetitive Avalanche Curves , Figures 15, 16:**
**(For further info, see AN-1005 at www.irf.com)**

1. Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of $T_{jmax}$. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as $T_{jmax}$ is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. $I_{av}$ = Allowable avalanche current.
7. $\Delta T$ = Allowable rise in junction temperature, not to exceed $T_{jmax}$ (assumed as 25°C in Figure 15, 16).
   $t_{av}$ = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance, see Figures 11)

$$P_{D\ (ave)} = 1/2\ (1.3 \cdot BV \cdot I_{av}) = \Delta T / Z_{thJC}$$
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$
$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

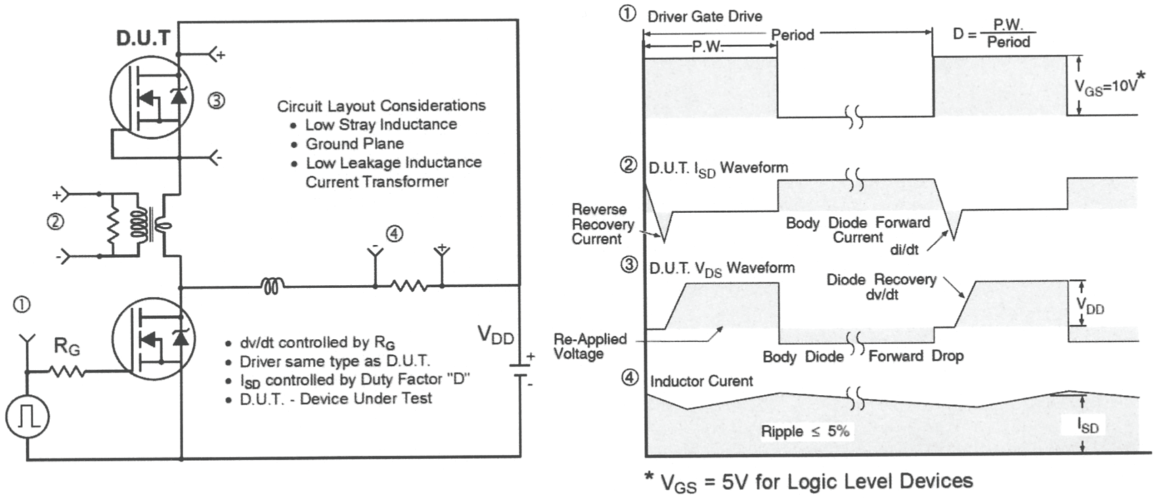



**Fig 17.** Peak Diode Recovery dv/dt Test Circuit for N-Channel HEXFET® Power MOSFETs

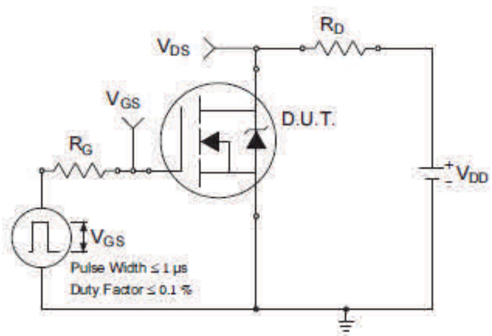



**Fig 18a.** Switching Time Test Circuit

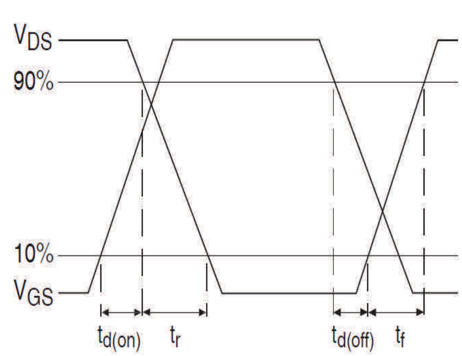
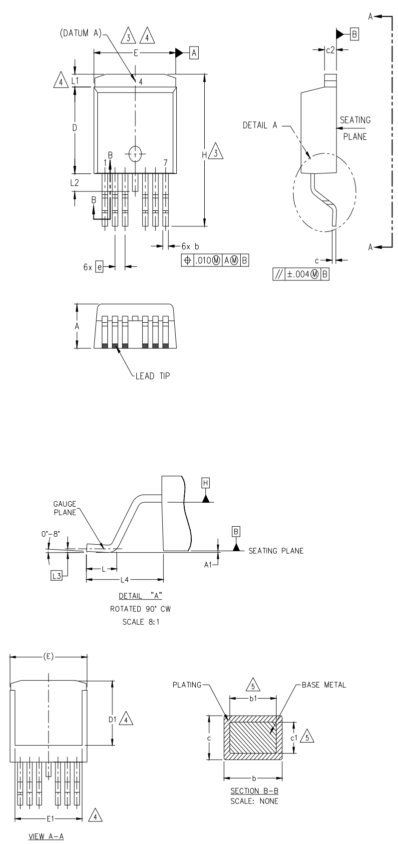



**Fig 18b.** Switching Time Waveforms

## $D^2$Pak - 7 Pin Package Outline

Dimensions are shown in millimeters (inches)

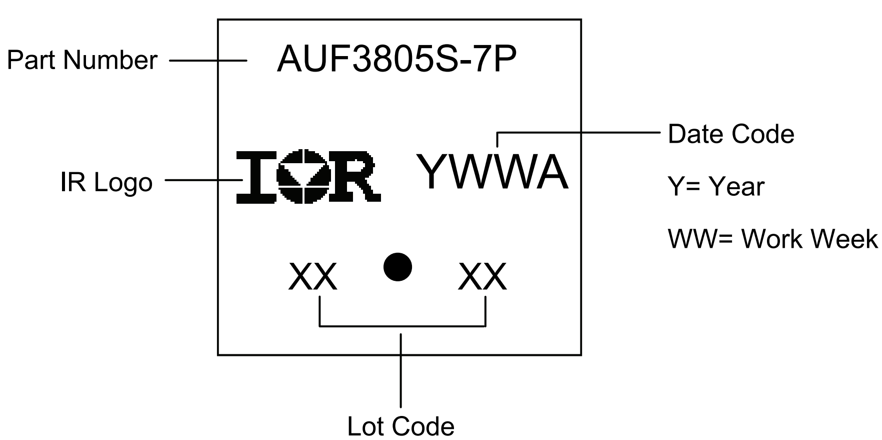



| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | — | 0.254 | — | .010 | |
| b | 0.51 | 0.99 | .020 | .036 | |
| b1 | 0.51 | 0.89 | .020 | .032 | 5 |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 5 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.38 | 9.65 | .330 | .380 | 3 |
| D1 | 6.86 | — | .270 | | 4 |
| E | 9.65 | 10.67 | .380 | .420 | 3,4 |
| E1 | 6.22 | — | .245 | | 4 |
| e | 1.27 BSC | | .050 BSC | | |
| H | 14.61 | 15.88 | .575 | .625 | |
| L | 1.78 | 2.79 | .070 | .110 | |
| L1 | — | 1.68 | — | .066 | 4 |
| L2 | — | 1.78 | — | .070 | |
| L3 | 0.25 BSC | | .010 BSC | | |
| L4 | 4.78 | 5.28 | .188 | .208 | |

NOTES:

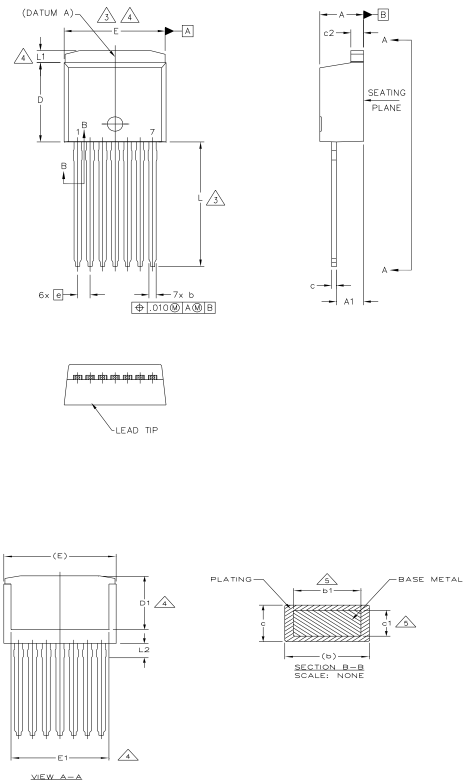
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. (△) DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. (△) THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. (△) DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263CB.

## $D^2$Pak - 7 Pin Part Marking Information



## TO-263CA - 7 Pin Long Leads Package Outline

Dimensions are shown in millimeters (inches)




NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. CONTROLLING DIMENSION: INCH.
7.- OUTLINE CONFORM TO JEDEC TO-263 CA

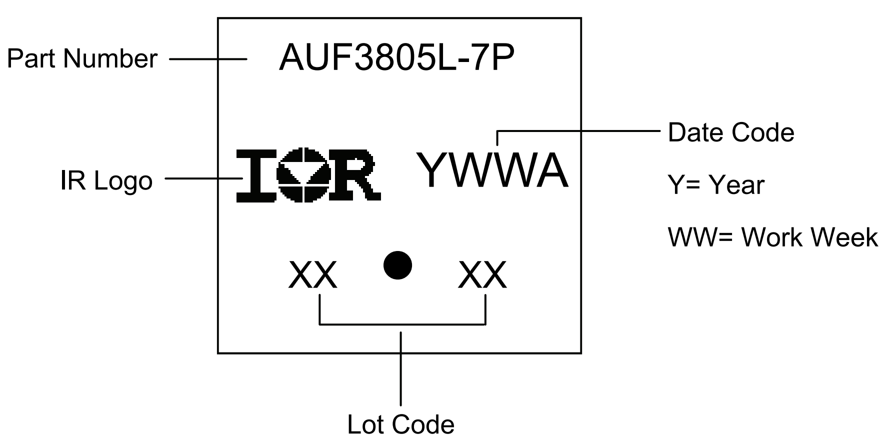
| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 2.03 | 3.02 | .080 | .119 | |
| b | 0.51 | 0.91 | .020 | .036 | |
| b1 | 0.51 | 0.81 | .020 | .032 | 5 |
| c | 0.38 | 0.74 | .015 | .029 | |
| c1 | 0.38 | 0.58 | .015 | .023 | 5 |
| c2 | 1.14 | 1.65 | .045 | .065 | |
| D | 8.51 | 9.65 | .335 | .380 | 3 |
| D1 | 6.86 | – | .270 | – | 4 |
| E | 9.65 | 10.67 | .380 | .420 | 3,4 |
| E1 | 6.22 | – | .245 | | 4 |
| e | 1.27 BSC | | .050 BSC | | |
| L | 13.46 | 14.10 | .530 | .555 | |
| L1 | – | 1.65 | – | .065 | 4 |
| L2 | – | 6.35 | – | .250 | |

LEAD ASSIGNMENTS

HEXFET

1.- GATE
2.- SOURCE
3.- SOURCE
4.- DRAIN
5.- SOURCE
6.- SOURCE
7.- SOURCE

## TO-263CA - 7 Pin Part Marking Information

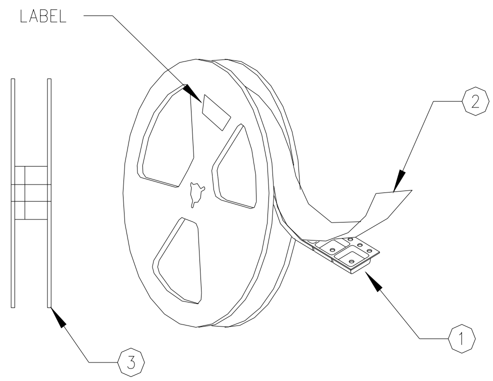


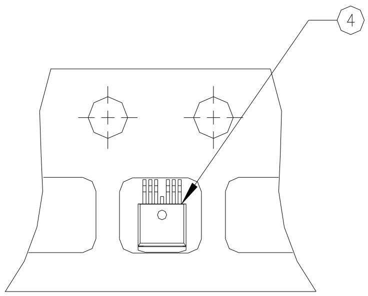
## D2Pak - 7 Pin Tape and Reel

NOTES, TAPE & REEL, LABELLING:

1. TAPE AND REEL.
   - 1.1 REEL SIZE 13 INCH DIAMETER.
   - 1.2 EACH REEL CONTAINING 800 DEVICES.
   - 1.3 THERE SHALL BE A MINIMUM OF 42 SEALED POCKETS CONTAINED IN THE LEADER AND A MINIMUM OF 15 SEALED POCKETS IN THE TRAILER.
   - 1.4 PEEL STRENGTH MUST CONFORM TO THE SPEC. NO. 71-9667.
   - 1.5 PART ORIENTATION SHALL BE AS SHOWN BELOW.
   - 1.6 REEL MAY CONTAIN A MAXIMUM OF TWO UNIQUE LOT CODE/DATE CODE COMBINATIONS. REWORKED REELS MAY CONTAIN A MAXIMUM OF THREE UNIQUE LOT CODE/DATE CODE COMBINATIONS. HOWEVER, THE LOT CODES AND DATE CODES WITH THEIR RESPECTIVE QUANTITIES SHALL APPEAR ON THE BAR CODE LABEL FOR THE AFFECTED REEL.

2. LABELLING (REEL AND SHIPPING BAG).
   - 2.1 CUST. PART NUMBER (BAR CODE): IRFXXXXSTRL-7P
   - 2.2 CUST. PART NUMBER (TEXT CODE): IRFXXXXSTRL-7P
   - 2.3 I.R. PART NUMBER: IRFXXXXSTRL-7P
   - 2.4 QUANTITY:
   - 2.5 VENDOR CODE: IR
   - 2.6 LOT CODE:
   - 2.7 DATE CODE:



**Qualification Information**

| | | | |
|---|---|---|---|
| **Qualification Level** | | Automotive<br>(per AEC-Q101) | |
| | | Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level. | |
| | | $D^2$ PAK 7 Pin | MSL1, 260°C |
| **ESD** | Machine Model | Class M4(+/-425V)† (Per AEC-Q101-002) | |
| | Human Body Model | Class H3A(+/-4000V)† (per AEC-Q101-001) | |
| | Charged Device Model | Class C5 (+/-1000V)† (per AEC-Q101-005) | |
| **RoHS Compliant** | | Yes | |

† Highest passing voltage.

## Revision History

| Date | Comments |
|---|---|
| 09/02/2015 | • Updated data sheet with corporate template.<br>• Corrected ordering table on page1. |
| 09/30/2015 | • Updated "Infineon" logo all pages.<br>• Updated disclaimer on last page |
| 10/09/2017 | • Corrected typo error on part marking on page 9,10. |

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