

IRFP15N60LPbF

HEXFET® Power MOSFET

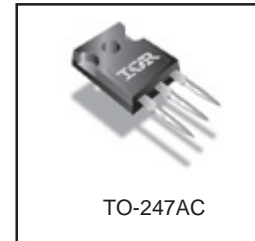
Applications

- Zero Voltage Switching SMPS
- Telecom and Server Power Supplies
- Uninterruptible Power Supplies
- Motor Control applications
- Lead-Free

| V _{DSS} | R _{DS(on) typ.} | T _{rr typ.} | I _D |
|------------------|--------------------------|----------------------|----------------|
| 600V | 385mΩ | 130ns | 15A |

Features and Benefits

- SuperFast body diode eliminates the need for external diodes in ZVS applications.
- Lower Gate charge results in simpler drive requirements.
- Enhanced dv/dt capabilities offer improved ruggedness.
- Higher Gate voltage threshold offers improved noise immunity.



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|------------------------|--------------|
| I _D @ T _C = 25°C | Continuous Drain Current, V _{GS} @ 10V | 15 | A |
| I _D @ T _C = 100°C | Continuous Drain Current, V _{GS} @ 10V | 9.7 | |
| I _{DM} | Pulsed Drain Current ① | 60 | |
| P _D @ T _C = 25°C | Power Dissipation | 280 | W |
| | Linear Derating Factor | 2.3 | W/°C |
| V _{GS} | Gate-to-Source Voltage | ±30 | V |
| dv/dt | Peak Diode Recovery dv/dt ② | 10 | V/ns |
| T _J T _{STG} | Operating Junction and Storage Temperature Range | -55 to + 150 | °C |
| | Soldering Temperature, for 10 seconds | 300 (1.6mm from case) | |
| | Mounting torque, 6-32 or M3 screw | 1.1(10) | |
| | | | N•m (lbf•in) |

Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|------------------|---|--|------|------|-------|---|
| I _S | Continuous Source Current (Body Diode) | — | — | 15 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I _{SM} | Pulsed Source Current (Body Diode) ① | — | — | 60 | | |
| V _{SD} | Diode Forward Voltage | — | — | 1.5 | V | T _J = 25°C, I _S = 15A, V _{GS} = 0V ④ |
| t _{rr} | Reverse Recovery Time | — | 130 | 200 | ns | T _J = 25°C, I _F = 15A |
| | | — | 240 | 360 | | T _J = 125°C, di/dt = 100A/μs ④ |
| Q _{rr} | Reverse Recovery Charge | — | 450 | 670 | nC | T _J = 25°C, I _S = 15A, V _{GS} = 0V ④ |
| | | — | 1080 | 1620 | | T _J = 125°C, di/dt = 100A/μs ④ |
| I _{RSM} | Reverse Recovery Current | — | 5.8 | 8.7 | A | T _J = 25°C |
| t _{on} | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

IRFP15N60LPbF

International
IR Rectifier

Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|------|------|------------|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 600 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.39 | — | V/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 385 | 460 | m Ω | $V_{GS} = 10V, I_D = 9.0A$ ④ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 3.0 | — | 5.0 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 50 | μA | $V_{DS} = 600V, V_{GS} = 0V$ |
| | | — | — | 2.0 | mA | $V_{DS} = 480V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 30V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | nA | $V_{GS} = -30V$ |
| R_G | Internal Gate Resistance | — | 0.79 | — | Ω | $f = 1\text{MHz}$, open drain |

Dynamic @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------------------|---|------|------|------|-------|--|
| g_{fs} | Forward Transconductance | 8.3 | — | — | S | $V_{DS} = 50V, I_D = 9.0A$ |
| Q_g | Total Gate Charge | — | — | 100 | nC | $I_D = 15A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 30 | | $V_{DS} = 480V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 46 | | $V_{GS} = 10V$, See Fig. 7 & 15 ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 20 | — | ns | $V_{DD} = 300V$ |
| t_r | Rise Time | — | 44 | — | | $I_D = 15A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 28 | — | | $R_G = 1.8\Omega$ |
| t_f | Fall Time | — | 5.5 | — | | $V_{GS} = 10V$, See Fig. 11a & 11b ④ |
| C_{iss} | Input Capacitance | — | 2720 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 260 | — | | $V_{DS} = 25V$ |
| C_{rss} | Reverse Transfer Capacitance | — | 20 | — | | $f = 1.0\text{MHz}$, See Fig. 5 |
| $C_{oss\ eff.}$ | Effective Output Capacitance | — | 120 | — | | $V_{GS} = 0V, V_{DS} = 0V$ to $480V$ ⑤ |
| $C_{oss\ eff. (ER)}$ | Effective Output Capacitance (Energy Related) | — | 100 | — | | |

Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|----------|---------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy ② | — | 320 | mJ |
| I_{AR} | Avalanche Current ① | — | 15 | A |
| E_{AR} | Repetitive Avalanche Energy ① | — | 28 | mJ |

Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.44 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient | — | 40 | |

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See Fig. 11)
- ② Starting $T_J = 25^\circ\text{C}$, $L = 2.9\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 15A$, $dv/dt = 10V/ns$. (See Figure 12a)
- ③ $I_{SD} \leq 15A$, $di/dt \leq 340A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.

④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.

⑤ $C_{oss\ eff.}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
 $C_{oss\ eff. (ER)}$ is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

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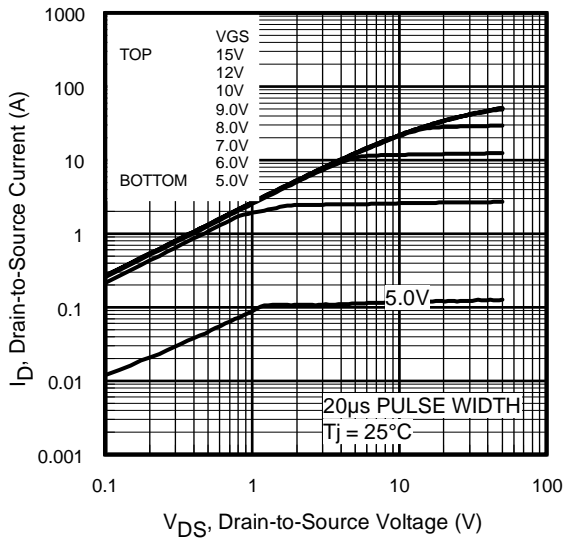


Fig 1. Typical Output Characteristics

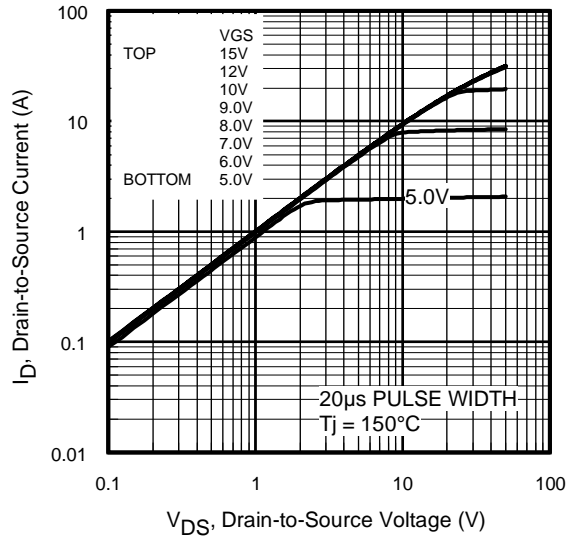


Fig 2. Typical Output Characteristics

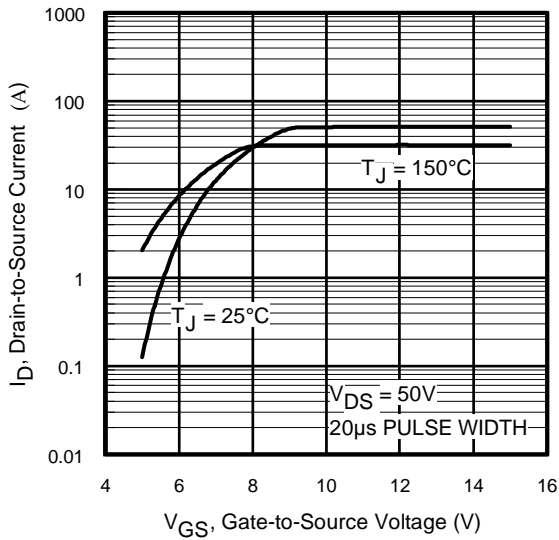


Fig 3. Typical Transfer Characteristics

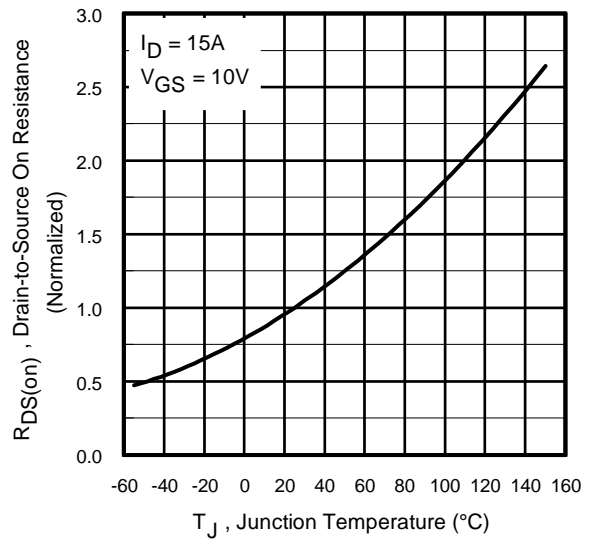


Fig 4. Normalized On-Resistance vs. Temperature

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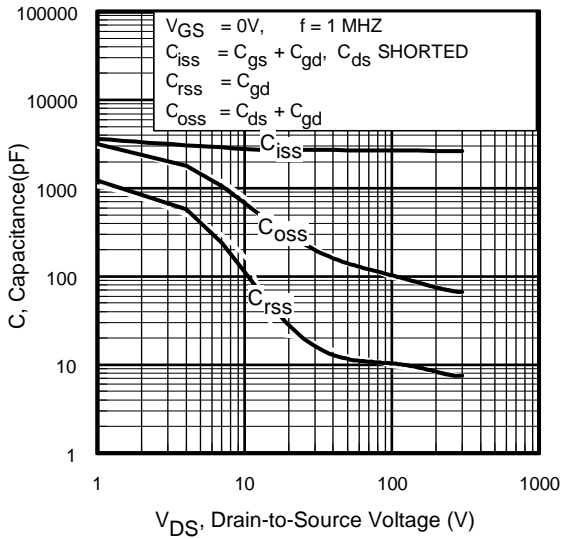


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage

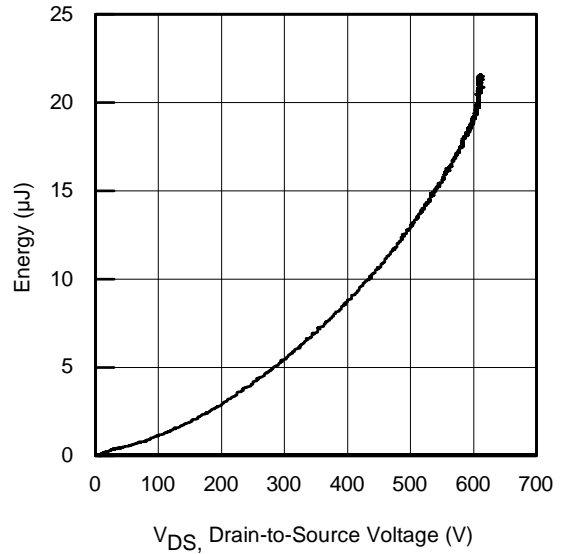


Fig 6. Typ. Output Capacitance Stored Energy vs. V_{DS}

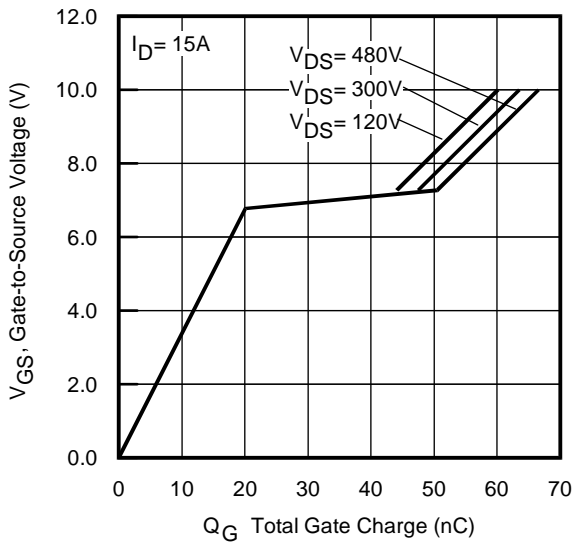


Fig 7. Typical Gate Charge vs. Gate-to-Source Voltage

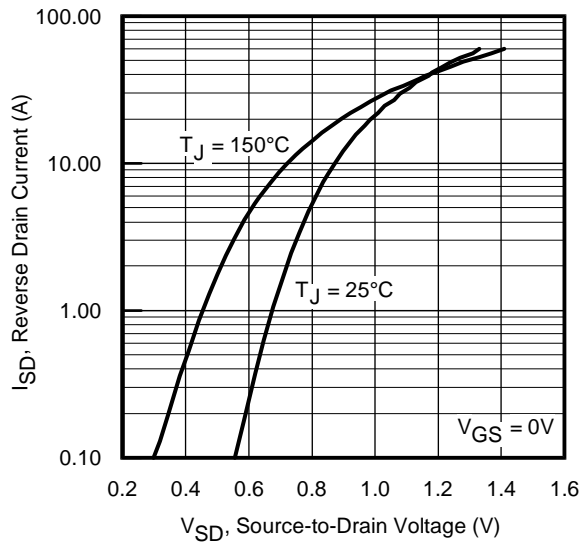


Fig 8. Typical Source-Drain Diode Forward Voltage

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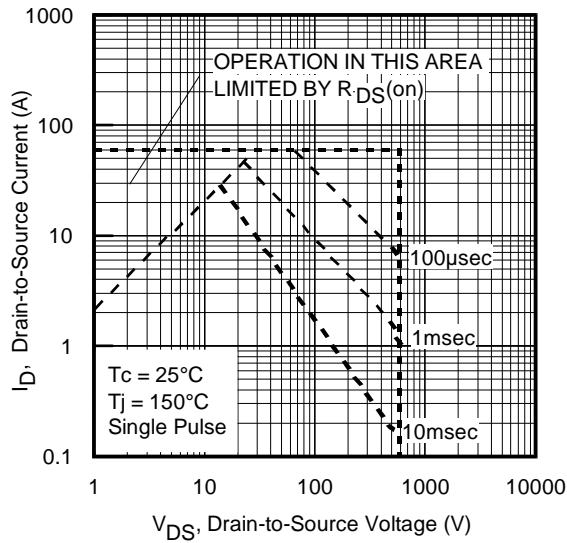


Fig 9. Maximum Safe Operating Area

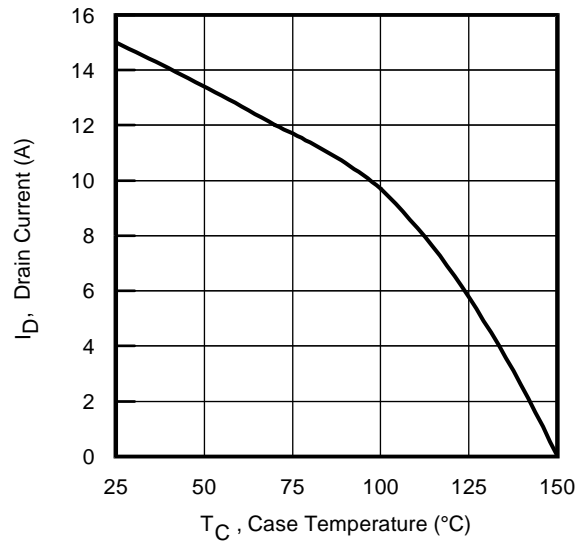


Fig 10. Maximum Drain Current vs. Case Temperature

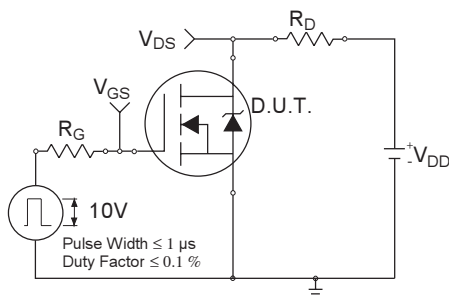


Fig 11a. Switching Time Test Circuit

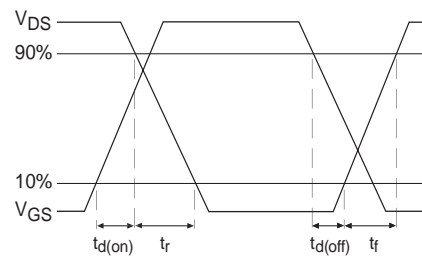


Fig 11b. Switching Time Waveforms

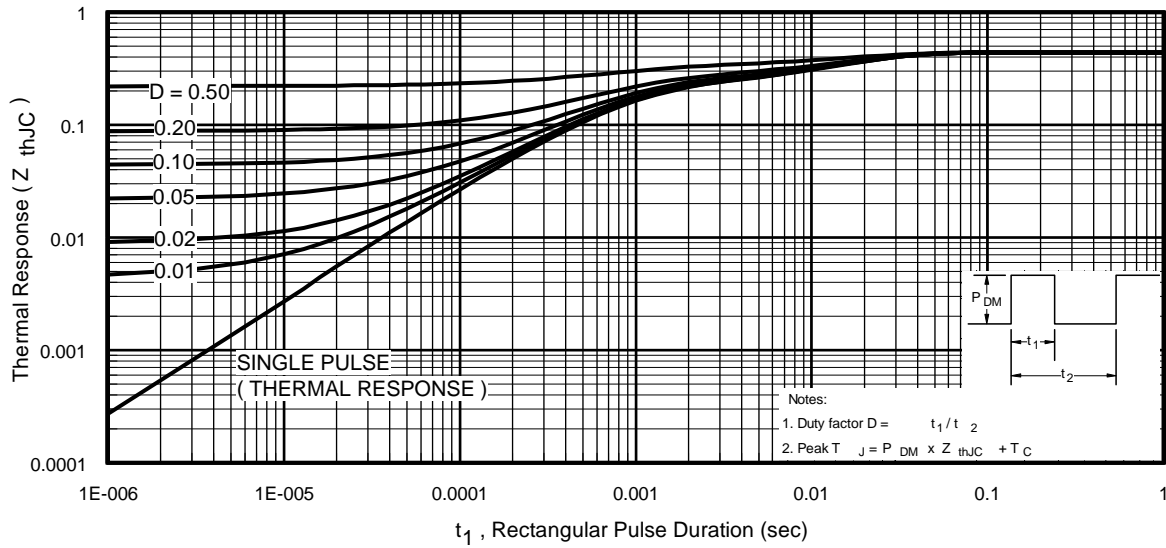


Fig 12. Maximum Effective Transient Thermal Impedance, Junction-to-Case

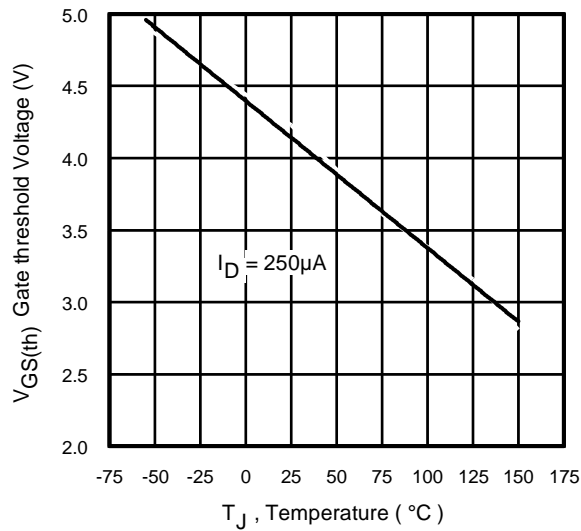


Fig 13. Threshold Voltage vs. Temperature

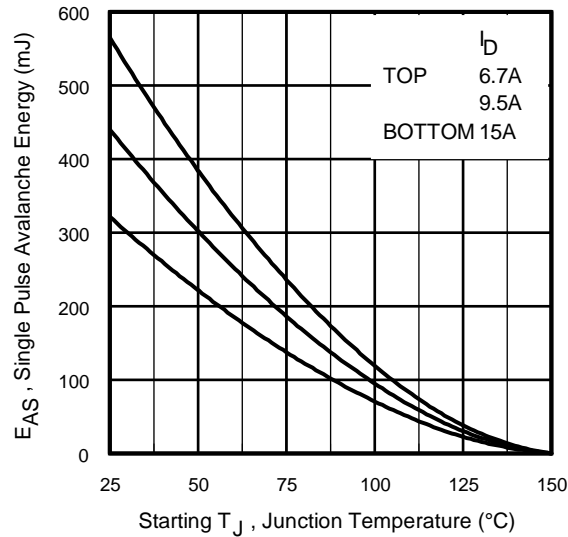


Fig 14a. Maximum Avalanche Energy vs. Drain Current

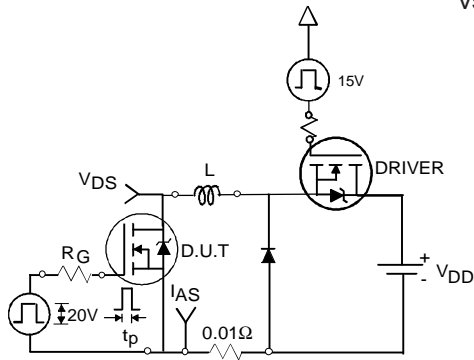


Fig 14b. Unclamped Inductive Test Circuit

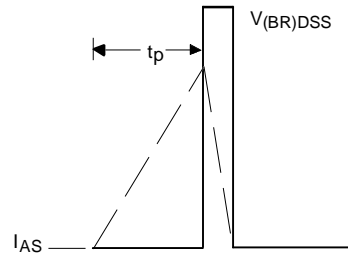


Fig 14c. Unclamped Inductive Waveforms

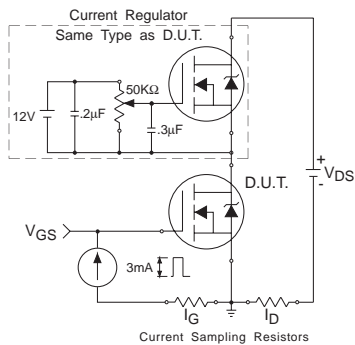


Fig 15a. Gate Charge Test Circuit

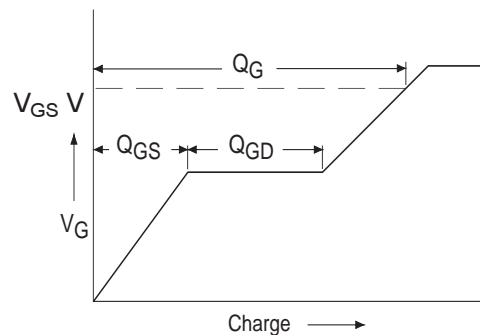
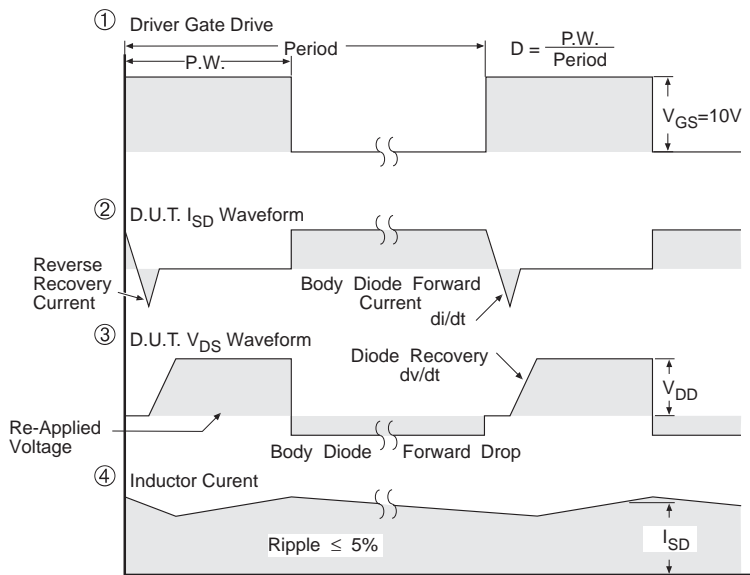
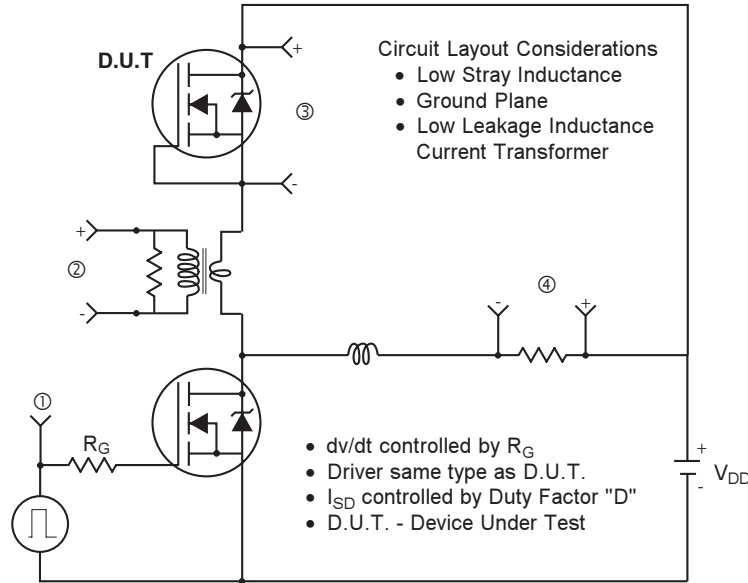


Fig 15b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit

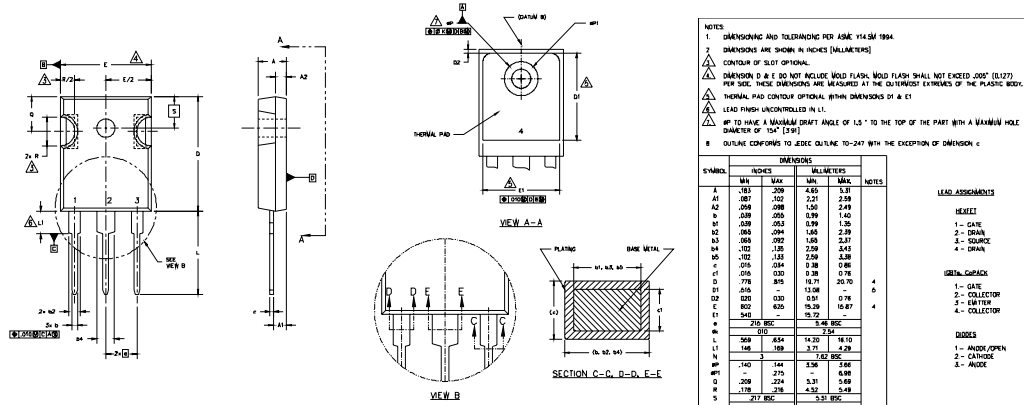


* $V_{GS} = 5V$ for Logic Level Devices

Fig 16. For N-Channel HEXFET® Power MOSFETs

TO-247AC Package Outline

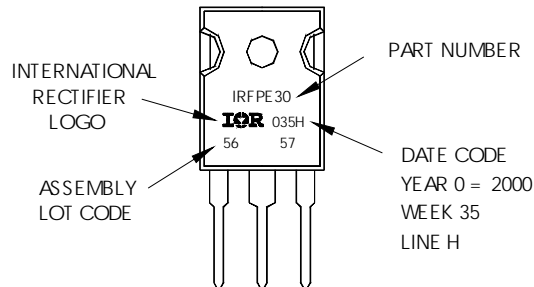
Dimensions are shown in millimeters (inches)



TO-247AC Part Marking Information

EXAMPLE: THIS IS AN IRFPE30
 WITH ASSEMBLY
 LOT CODE 5657
 ASSEMBLED ON WW 35, 2000
 IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position indicates "Lead-Free"



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

Data and specifications subject to change without notice.
 This product has been designed and qualified for the Industrial market.
 Qualification Standards can be found on IR's Web site.