

IRFPS43N50K

HEXFET® Power MOSFET

Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching
- Hard Switched and High Frequency Circuits

| V_{DSS} | $R_{DS(on)}$ typ. | I_D |
|-----------|-------------------|-------|
| 500V | 0.078Ω | 47A |

Benefits

- Low Gate Charge Q_g results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dv/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Low $R_{DS(on)}$



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------------|--|--------------|-------|
| $I_D @ T_C = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 47 | A |
| $I_D @ T_C = 100^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ 10\text{V}$ | 29 | |
| I_{DM} | Pulsed Drain Current ① | 190 | |
| $P_D @ T_C = 25^\circ\text{C}$ | Power Dissipation | 540 | W |
| | Linear Derating Factor | 4.3 | W/°C |
| V_{GS} | Gate-to-Source Voltage | ± 30 | V |
| | dv/dt Peak Diode Recovery dv/dt ③ | 12 | V/ns |
| T_J | Operating Junction and | -55 to + 150 | °C |
| T_{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |

Avalanche Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|----------|--------------------------------|------|------|-------|
| E_{AS} | Single Pulse Avalanche Energy② | — | 910 | mJ |
| I_{AR} | Avalanche Current① | — | 47 | A |
| E_{AR} | Repetitive Avalanche Energy① | — | 54 | mJ |

Thermal Resistance

| Symbol | Parameter | Typ. | Max. | Units |
|-----------------|-------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case④ | — | 0.23 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient④ | — | 40 | |

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International
IR Rectifier

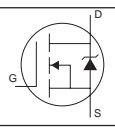
Static @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---------------------------------|--------------------------------------|------|-------|-------|----------|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 500 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.60 | — | V/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ Ⓞ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 0.078 | 0.090 | Ω | $V_{GS} = 10V, I_D = 28A$ 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 | $V_{DS} = 500V, V_{GS} = 0V$ |
| | | — | — | 250 | μA | $V_{DS} = 400V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 30V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS} = -30V$ |

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

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|------------------------|---------------------------------|------|-------|------|-------|---|
| g_{fs} | Forward Transconductance | 23 | — | — | S | $V_{DS} = 50V, I_D = 28A$ |
| Q_g | Total Gate Charge | — | — | 350 | nC | $I_D = 47A$ |
| Q_{gs} | Gate-to-Source Charge | — | — | 85 | | $V_{DS} = 400V$ |
| Q_{gd} | Gate-to-Drain ("Miller") Charge | — | — | 180 | | $V_{GS} = 10V, \text{See Fig. 6 and 13}$ ④ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 25 | — | ns | $V_{DD} = 250V$ |
| t_r | Rise Time | — | 140 | — | | $I_D = 47A$ |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 55 | — | | $R_G = 1.0\Omega$ |
| t_f | Fall Time | — | 74 | — | | $V_{GS} = 10V, \text{See Fig. 10}$ ④ |
| C_{iss} | Input Capacitance | — | 8310 | — | pF | $V_{GS} = 0V$ |
| C_{oss} | Output Capacitance | — | 960 | — | | $V_{DS} = 25V$ |
| C_{riss} | Reverse Transfer Capacitance | — | 120 | — | | $f = 1.0\text{MHz}, \text{See Fig. 5}$ |
| C_{oss} | Output Capacitance | — | 10170 | — | | $V_{GS} = 0V, V_{DS} = 1.0V, f = 1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | — | 240 | — | | $V_{GS} = 0V, V_{DS} = 400V, f = 1.0\text{MHz}$ |
| $C_{oss \text{ eff.}}$ | Effective Output Capacitance | — | 440 | — | | $V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$ ④ |

Diode Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Units | Conditions |
|-----------|--|---|------|------|---------|--|
| I_S | Continuous Source Current (Body Diode) | — | — | 47 | A | MOSFET symbol showing the integral reverse p-n junction diode.  |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 190 | | |
| V_{SD} | Diode Forward Voltage | — | — | 1.5 | V | $T_J = 25^\circ\text{C}, I_S = 47A, V_{GS} = 0V$ ④ |
| t_{rr} | Reverse Recovery Time | — | 620 | 940 | ns | $T_J = 25^\circ\text{C}, I_F = 47A$ |
| Q_{rr} | Reverse Recovery Charge | — | 14 | 21 | μC | $di/dt = 100A/\mu s$ ④ |
| I_{RRM} | Reverse Recovery Current | — | 38 | — | A | |
| 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 Starting $T_J = 25^\circ\text{C}$, $L = 0.82\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 47A$ (See Figure 12a).
- ③ $I_{SD} \leq 47A$, $di/dt \leq 344A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$.
- ④ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ⑤ $C_{oss \text{ eff.}}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑥ R_θ is measured at T_J approximately 90°C

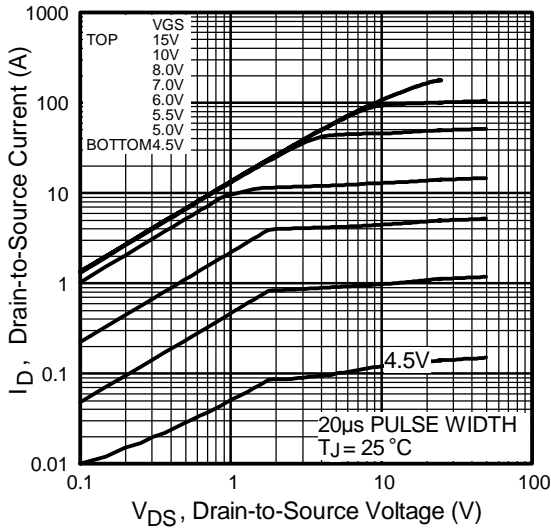


Fig 1. Typical Output Characteristics

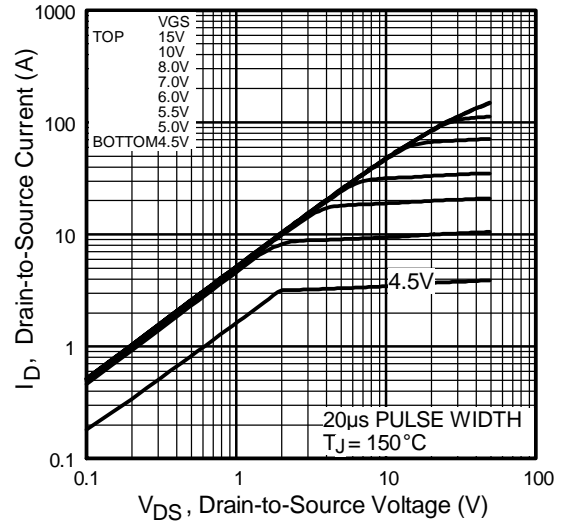


Fig 2. Typical Output Characteristics

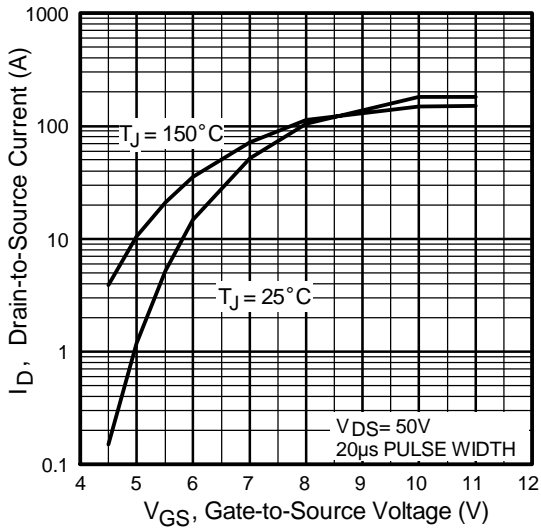


Fig 3. Typical Transfer Characteristics

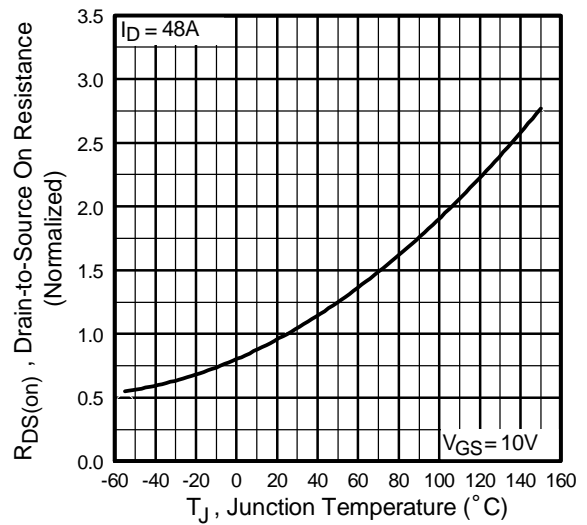


Fig 4. Normalized On-Resistance Vs. Temperature

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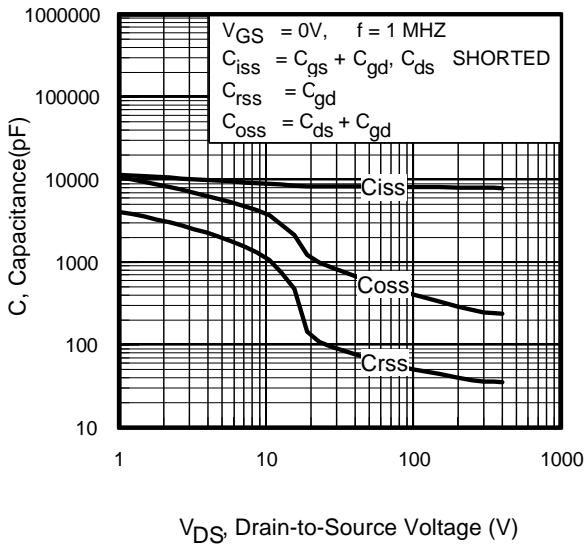


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

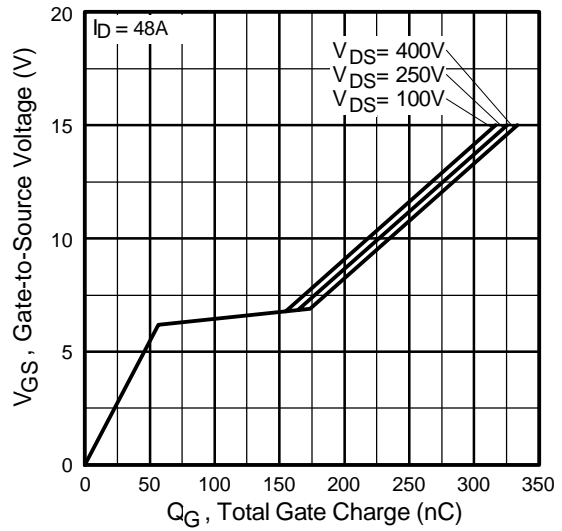


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

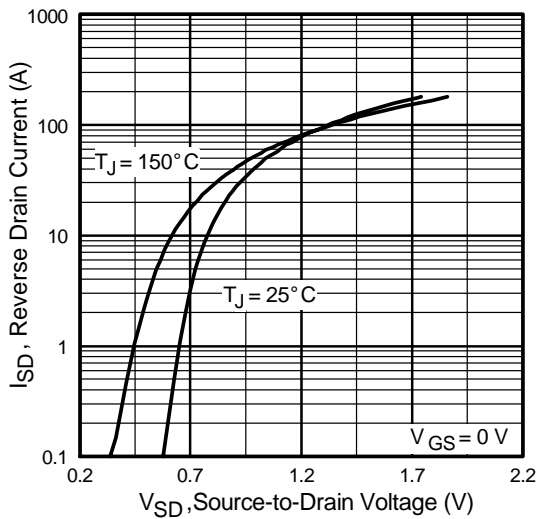


Fig 7. Typical Source-Drain Diode Forward Voltage

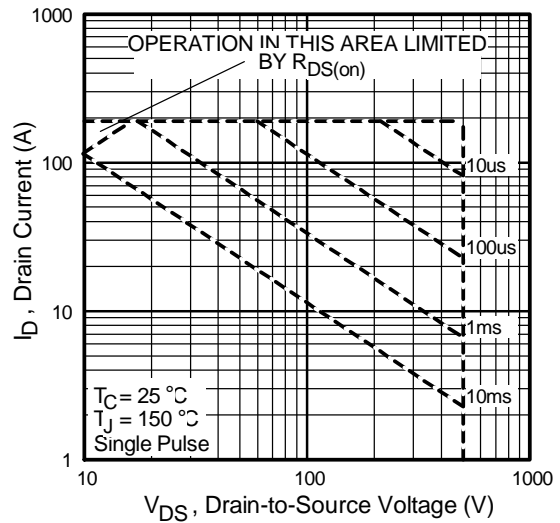


Fig 8. Maximum Safe Operating Area

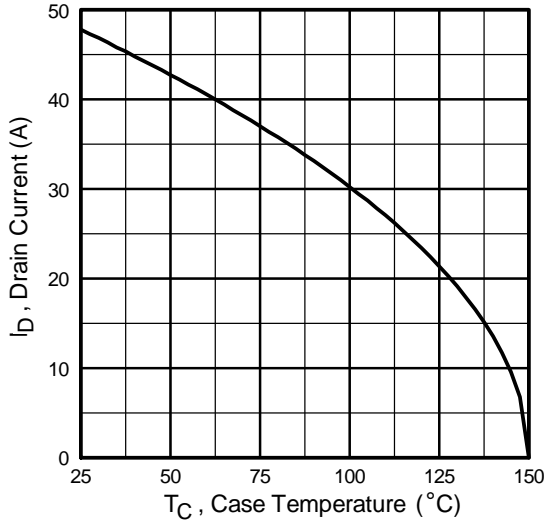


Fig 9. Maximum Drain Current Vs. Case Temperature

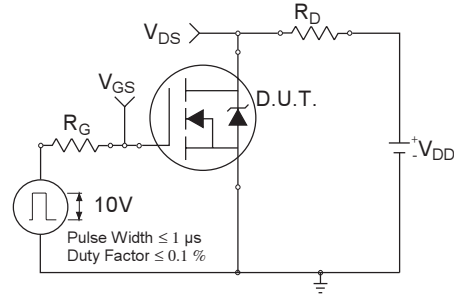


Fig 10a. Switching Time Test Circuit

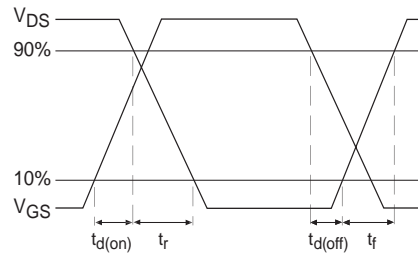


Fig 10b. Switching Time Waveforms

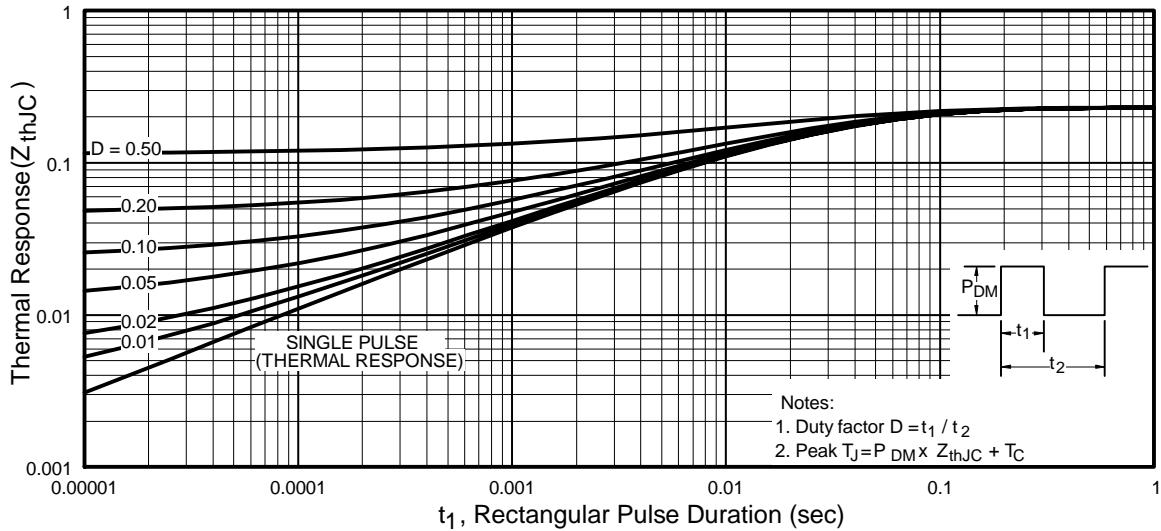


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

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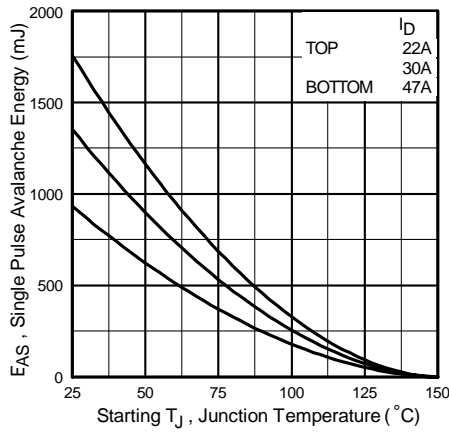


Fig 12a. Maximum Avalanche Energy Vs. Drain Current

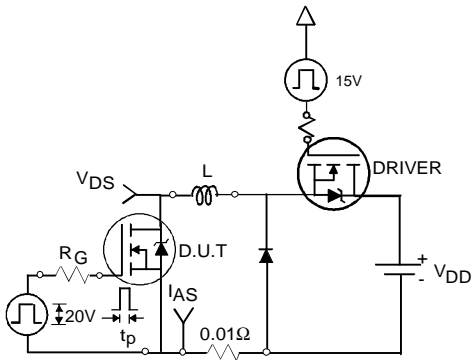


Fig 12b. Unclamped Inductive Test Circuit

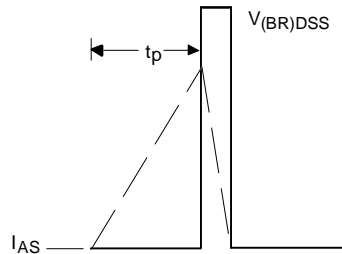


Fig 12c. Unclamped Inductive Waveforms

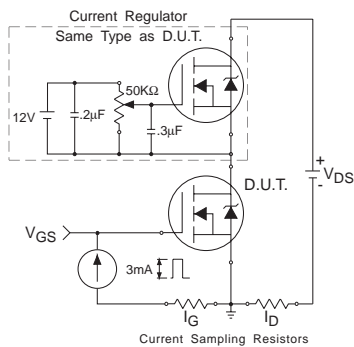


Fig 13a. Gate Charge Test Circuit

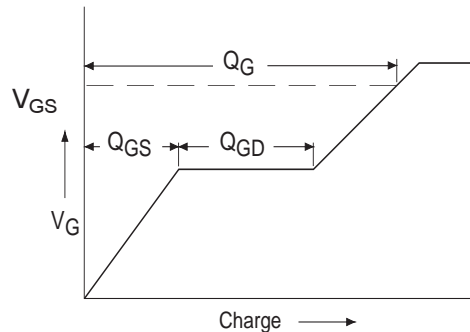
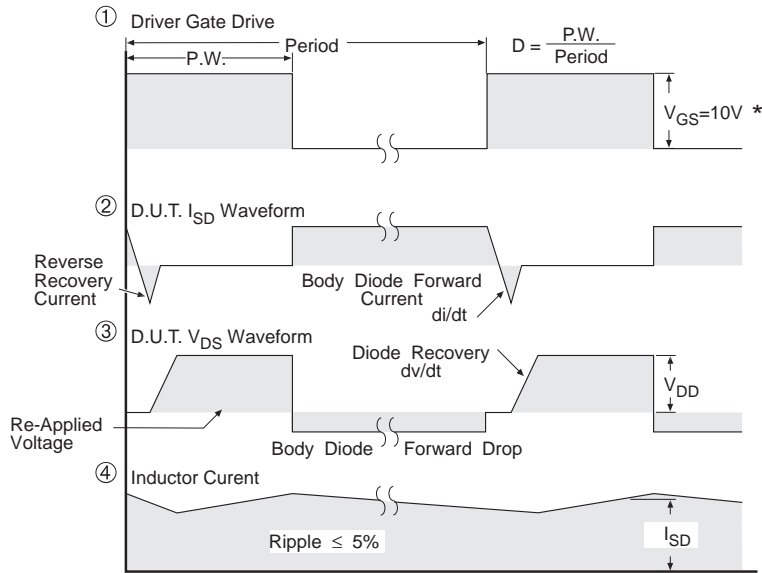
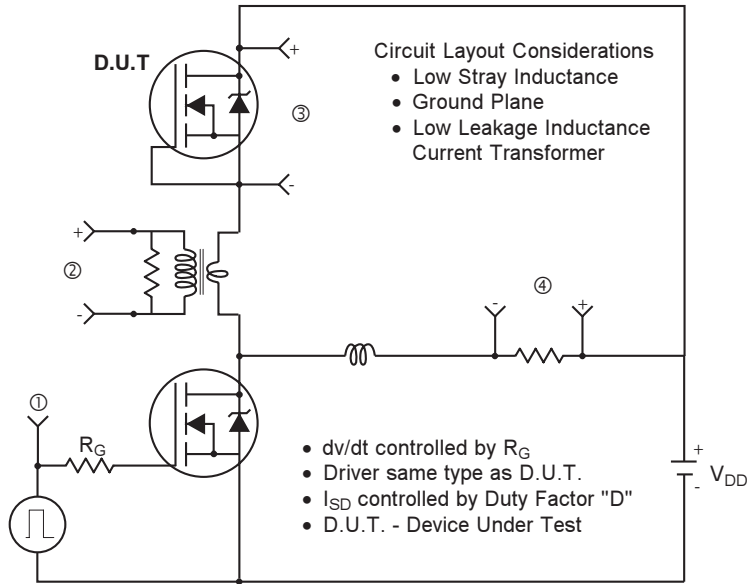


Fig 13b. Basic Gate Charge Waveform

Peak Diode Recovery dv/dt Test Circuit



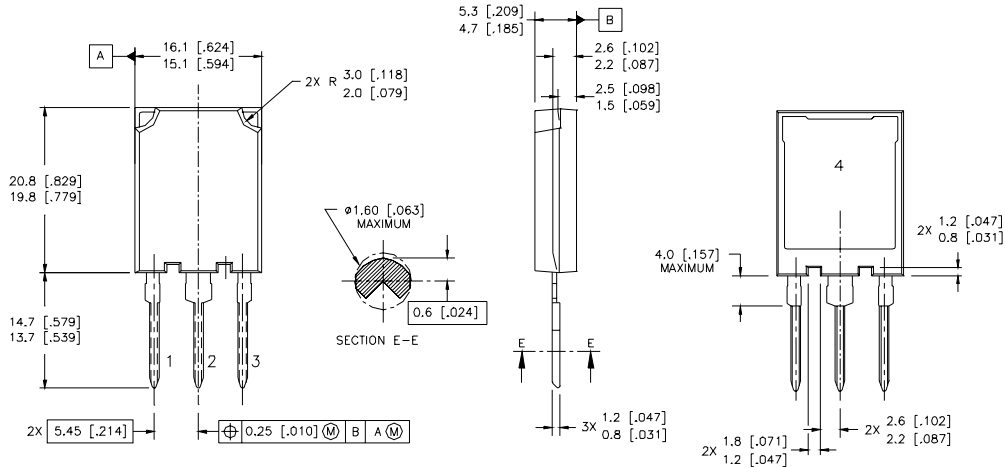
* $V_{GS} = 5V$ for Logic Level Devices

Fig 14. For N-Channel HEXFET® Power MOSFETs

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Case Outline and Dimensions — Super-247



NOTES:

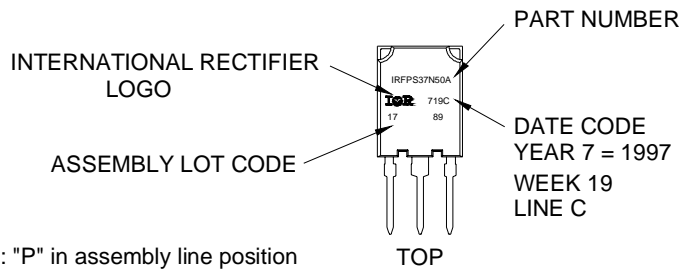
1. DIMENSIONS & TOLERANCING PER ASME Y14.5M-1994
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETRES [INCHES]

LEAD ASSIGNMENTS

| MOSFET | IGBT |
|------------|---------------|
| 1 - GATE | 1 - GATE |
| 2 - DRAIN | 2 - COLLECTOR |
| 3 - SOURCE | 3 - EMITTER |
| 4 - DRAIN | 4 - COLLECTOR |

Super-247 (TO-274AA) Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH
ASSEMBLY LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



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

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.

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

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