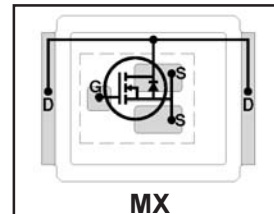


IRF6620

HEXFET® Power MOSFET

- Application Specific MOSFETs
- Ideal for CPU Core DC-DC Converters
- Low Conduction Losses
- Low Switching Losses
- Low Profile (<0.7 mm)
- Dual Sided Cooling Compatible
- Compatible with Existing Surface Mount Techniques

| V_{DSS} | $R_{DS(on)}$ max | Qg(typ.) |
|-----------|-------------------------|----------|
| 20V | 2.7mΩ @ $V_{GS} = 10V$ | 28nC |
| | 3.6mΩ @ $V_{GS} = 4.5V$ | |



Applicable DirectFET Outline and Substrate Outline (see p.8,9 for details)

| | | | | | | | | | |
|----|----|----|--|----|-----------|----|--|--|--|
| SQ | SX | ST | | MQ | MX | MT | | | |
|----|----|----|--|----|-----------|----|--|--|--|

Description

The IRF6620 combines the latest HEXFET® Power MOSFET Silicon technology with the advanced DirectFET™ packaging to achieve the lowest on-state resistance in a package that has the footprint of an SO-8 and only 0.7 mm profile. The DirectFET package is compatible with existing layout geometries used in power applications, PCB assembly equipment and vapor phase, infra-red or convection soldering techniques, when application note AN-1035 is followed regarding the manufacturing methods and processes. The DirectFET package allows dual sided cooling to maximize thermal transfer in power systems, IMPROVING previous best thermal resistance by 80%.

The IRF6620 balances both low resistance and low charge along with ultra low package inductance to reduce both conduction and switching losses. The reduced total losses make this product ideal for high efficiency DC-DC converters that power the latest generation of processors operating at higher frequencies. The IRF6620 has been optimized for parameters that are critical in synchronous buck operating from 12 volt bus converters including $R_{ds(on)}$, gate charge and $C_{dv/dt}$ -induced turn on immunity. The IRF6620 offers particularly low $R_{ds(on)}$ and high $C_{dv/dt}$ immunity for synchronous FET applications.

Absolute Maximum Ratings

| | Parameter | Max. | Units |
|--------------------------|---|--------------|-------|
| V_{DS} | Drain-to-Source Voltage | 20 | V |
| V_{GS} | Gate-to-Source Voltage | ±20 | |
| $I_D @ T_C = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ④ | 150 | A |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ④ | 27 | |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V$ ⑦ | 22 | |
| I_{DM} | Pulsed Drain Current ① | 220 | |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation ④ | 2.8 | W |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation ④ | 1.8 | |
| $P_D @ T_C = 25^\circ C$ | Power Dissipation ⑦ | 89 | |
| E_{AS} | Single Pulse Avalanche Energy ② | 39 | mJ |
| I_{AR} | Avalanche Current ① | 22 | A |
| | Linear Derating Factor | 0.017 | W/°C |
| T_J T_{STG} | Operating Junction and Storage Temperature Range | -40 to + 150 | °C |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|--------------------|-------------------------|------|------|-------|
| $R_{\theta JA}$ | Junction-to-Ambient ④⑧ | — | 45 | °C/W |
| $R_{\theta JA}$ | Junction-to-Ambient ⑤⑧ | 12.5 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient ⑥⑧ | 20 | — | |
| $R_{\theta JC}$ | Junction-to-Case ⑦⑧ | — | 1.4 | |
| $R_{\theta J-PCB}$ | Junction-to-PCB Mounted | 1.0 | — | |

Notes ① through ⑧ are on page 2

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|--------------------------------|--------------------------------------|------|------|------|------------|--|
| BV_{DSS} | Drain-to-Source Breakdown Voltage | 20 | — | — | V | $V_{GS} = 0V, I_D = 250\mu A$ |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 16 | — | mV/°C | Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ |
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | — | 2.1 | 2.7 | m Ω | $V_{GS} = 10V, I_D = 27A$ ③ |
| | | — | 2.8 | 3.6 | | $V_{GS} = 4.5V, I_D = 22A$ ③ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 1.55 | — | 2.45 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient | — | -5.8 | — | mV/°C | |
| I_{DSS} | Drain-to-Source Leakage Current | — | — | 1.0 | μA | $V_{DS} = 16V, V_{GS} = 0V$ |
| | | — | — | 150 | | $V_{DS} = 16V, V_{GS} = 0V, T_J = 125^\circ\text{C}$ |
| I_{GSS} | Gate-to-Source Forward Leakage | — | — | 100 | nA | $V_{GS} = 20V$ |
| | Gate-to-Source Reverse Leakage | — | — | -100 | | $V_{GS} = -20V$ |
| g_{fs} | Forward Transconductance | 110 | — | — | S | $V_{DS} = 10V, I_D = 22A$ |
| Q_g | Total Gate Charge | — | 28 | 42 | nC | $V_{DS} = 10V$ $V_{GS} = 4.5V$ $I_D = 22A$ See Fig. 15 |
| Q_{gs1} | Pre-Vth Gate-to-Source Charge | — | 9.5 | — | | |
| Q_{gs2} | Post-Vth Gate-to-Source Charge | — | 3.5 | — | | |
| Q_{gd} | Gate-to-Drain Charge | — | 8.8 | — | | |
| Q_{gdR} | Gate Charge Overdrive | — | 6.2 | — | | |
| Q_{sw} | Switch Charge ($Q_{gs2} + Q_{gd}$) | — | 12 | — | | |
| Q_{oss} | Output Charge | — | 16 | — | nC | $V_{DS} = 10V, V_{GS} = 0V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 18 | — | ns | $V_{DD} = 16V, V_{GS} = 4.5V$ ③ $I_D = 22A$ Clamped Inductive Load |
| t_r | Rise Time | — | 80 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 20 | — | | |
| t_f | Fall Time | — | 6.6 | — | | |
| C_{iss} | Input Capacitance | — | 4130 | — | pF | $V_{GS} = 0V$ $V_{DS} = 10V$ $f = 1.0\text{MHz}$ |
| C_{oss} | Output Capacitance | — | 1160 | — | | |
| C_{rss} | Reverse Transfer Capacitance | — | 560 | — | | |

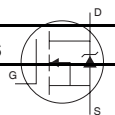
Diode Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|----------|--|------|------|------|-------|---|
| I_S | Continuous Source Current @ $T_C=25^\circ\text{C}$ (Body Diode) | — | — | 110 | A | MOSFET symbol showing the integral reverse p-n junction diode. |
| I_{SM} | Pulsed Source Current (Body Diode) ① | — | — | 220 | | |
| V_{SD} | Diode Forward Voltage | — | 0.8 | 1.0 | V | $T_J = 25^\circ\text{C}, I_S = 22A, V_{GS} = 0V$ ③ |
| t_{rr} | Reverse Recovery Time | — | 23 | 35 | ns | $T_J = 25^\circ\text{C}, I_F = 22A$ |
| Q_{rr} | Reverse Recovery Charge | — | 13 | 20 | nC | $di/dt = 100A/\mu s$ ③ |

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature.
- ② Starting $T_J = 25^\circ\text{C}$, $L = 0.16\text{mH}$,
 $R_G = 25\Omega, I_{AS} = 22A$.
- ③ Pulse width $\leq 400\mu s$; duty cycle $\leq 2\%$.
- ④ Surface mounted on 1 in. square Cu board.

- ⑤ Used double sided cooling, mounting pad.
- ⑥ Mounted on minimum footprint full size board with metalized back and with small clip heatsink.
- ⑦ T_C measured with thermal couple mounted to top (Drain) of part.
- ⑧ R_θ is measured at T_J of approximately 90°C .



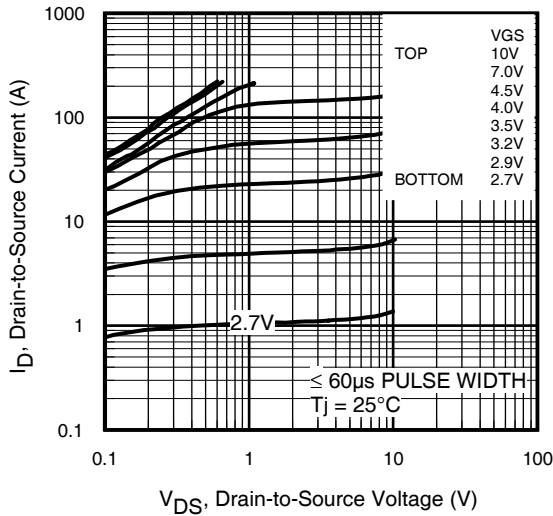


Fig 1. Typical Output Characteristics

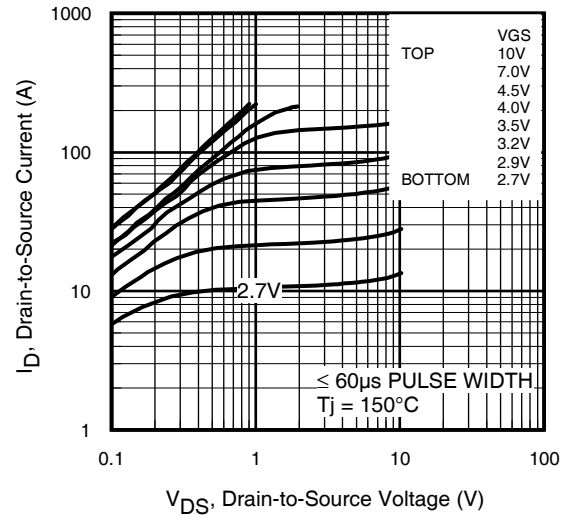


Fig 2. Typical Output Characteristics

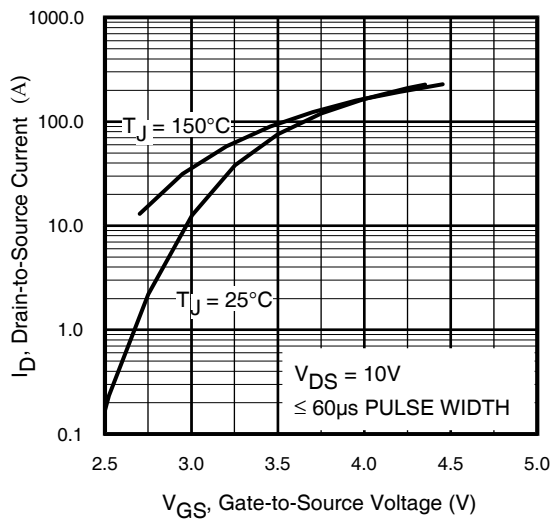


Fig 3. Typical Transfer Characteristics

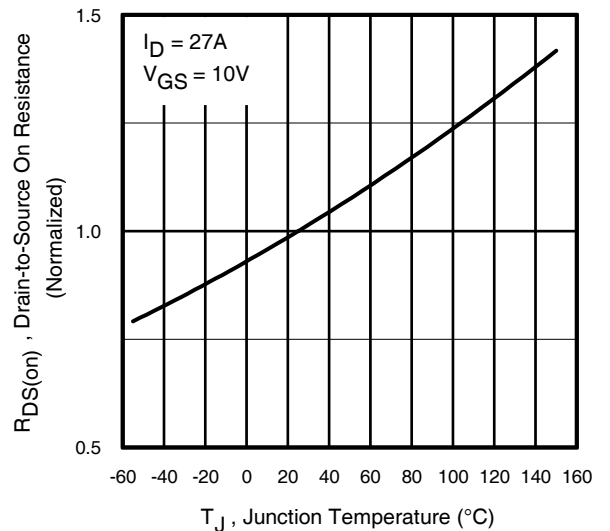


Fig 4. Normalized On-Resistance vs. Temperature

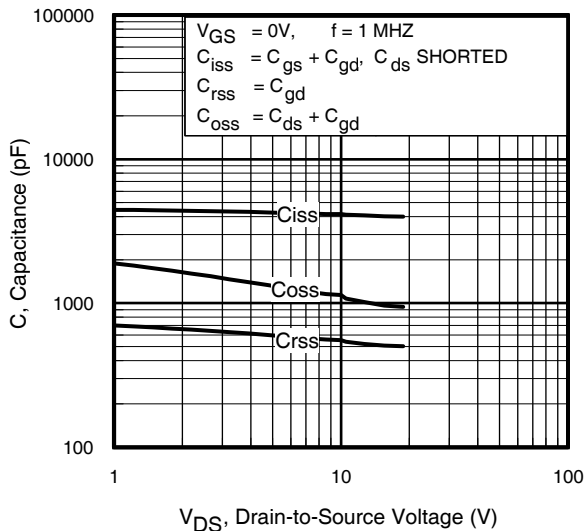


Fig 5. Typical Capacitance vs. Drain-to-Source Voltage
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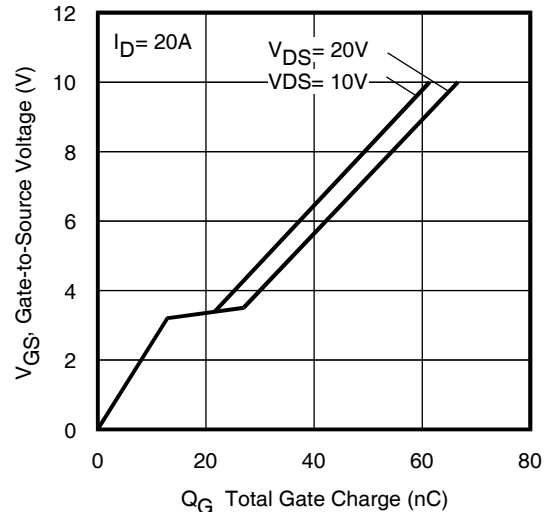


Fig 6. Typical Gate Charge vs. Gate-to-Source Voltage
3

IRF6620

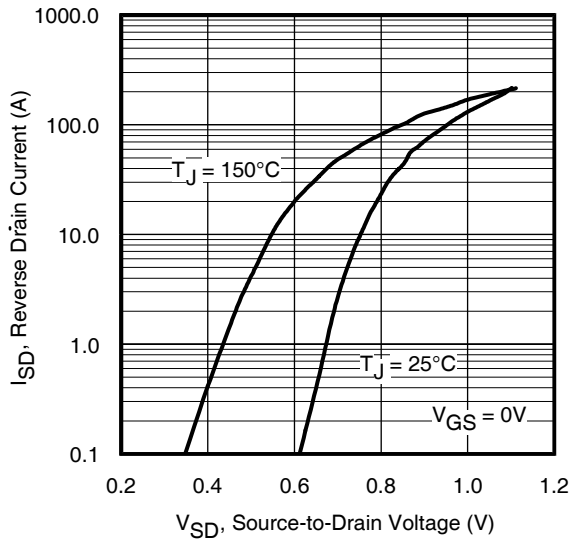


Fig 7. Typical Source-Drain Diode Forward Voltage

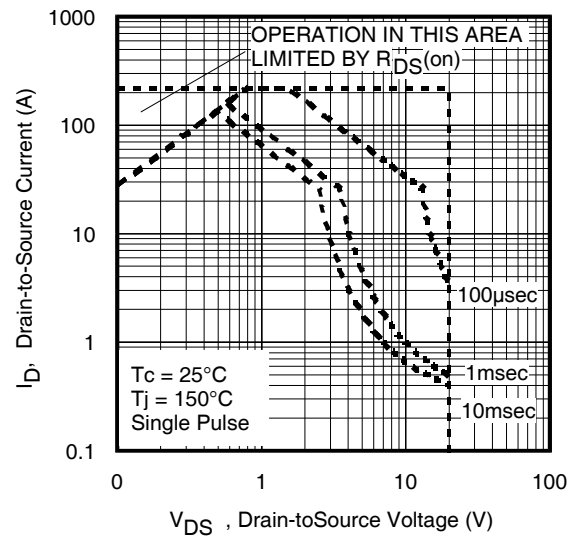


Fig 8. Maximum Safe Operating Area

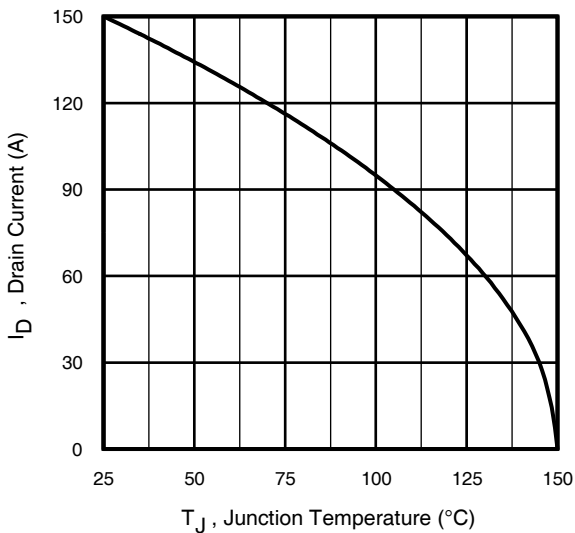


Fig 9. Maximum Drain Current vs. Case Temperature

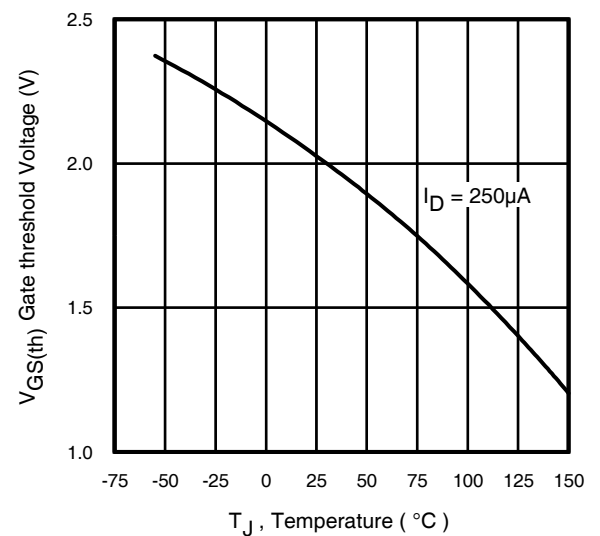


Fig 10. Threshold Voltage vs. Temperature

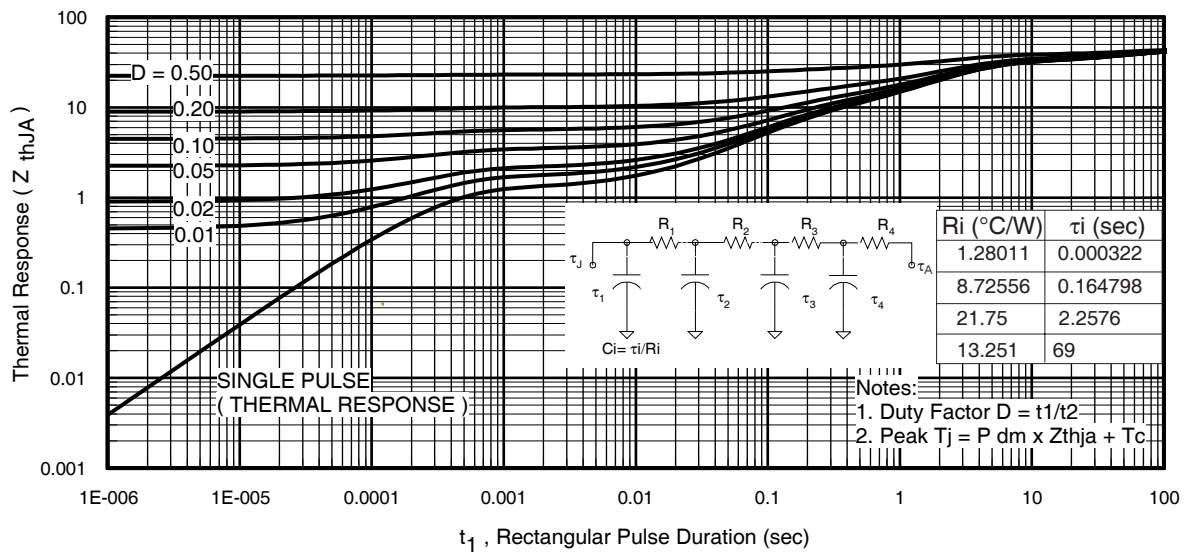


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

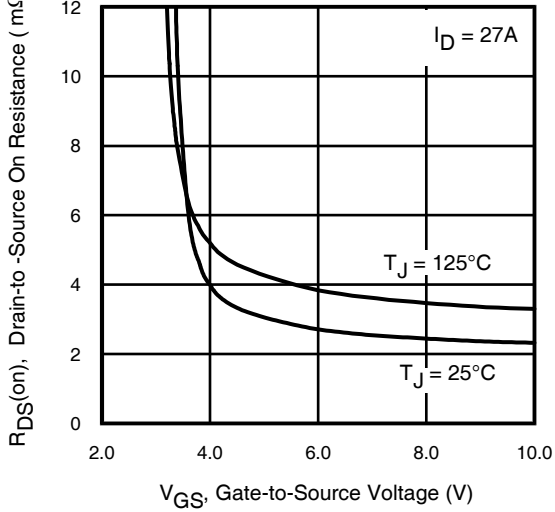


Fig 12. On-Resistance Vs. Gate Voltage

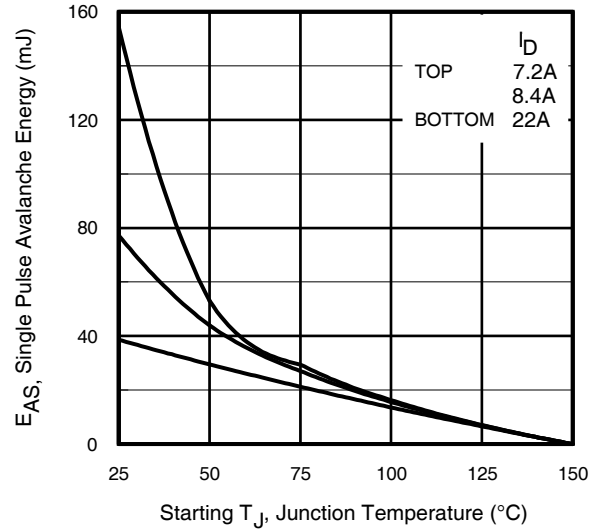


Fig 13c. Maximum Avalanche Energy Vs. Drain Current

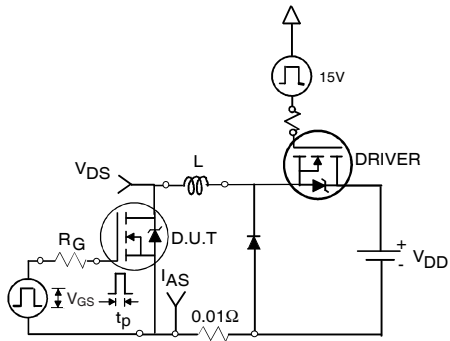


Fig 13a. Unclamped Inductive Test Circuit

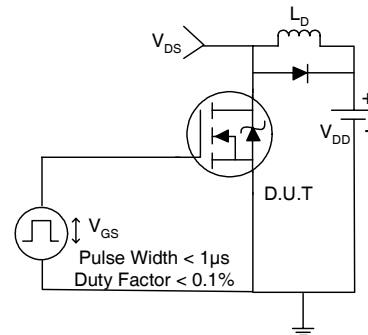


Fig 14a. Switching Time Test Circuit

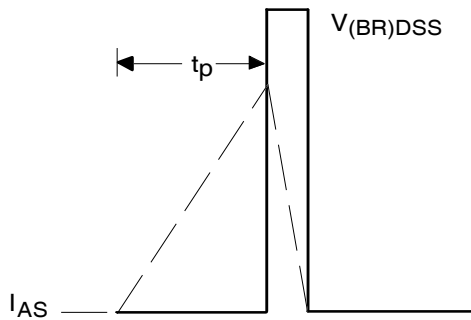


Fig 13b. Unclamped Inductive Waveforms

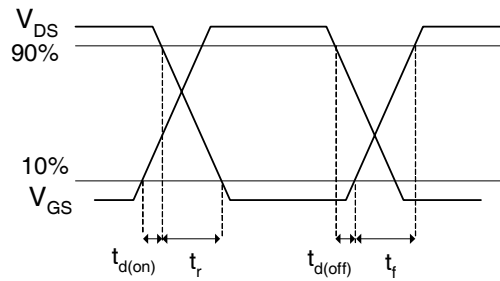


Fig 14b. Switching Time Waveforms

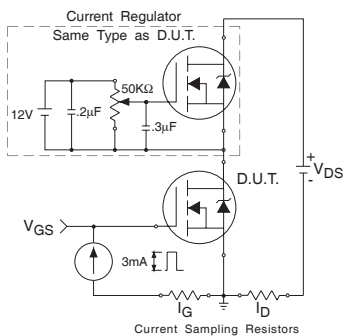


Fig 15a. Gate Charge Test Circuit

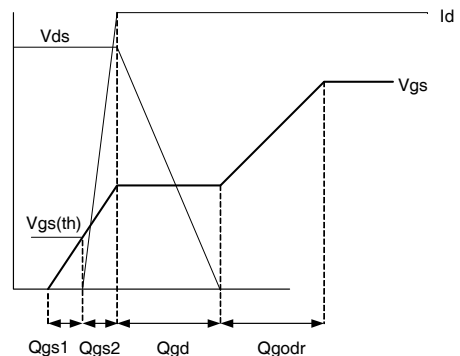


Fig 15b. Gate Charge Waveform

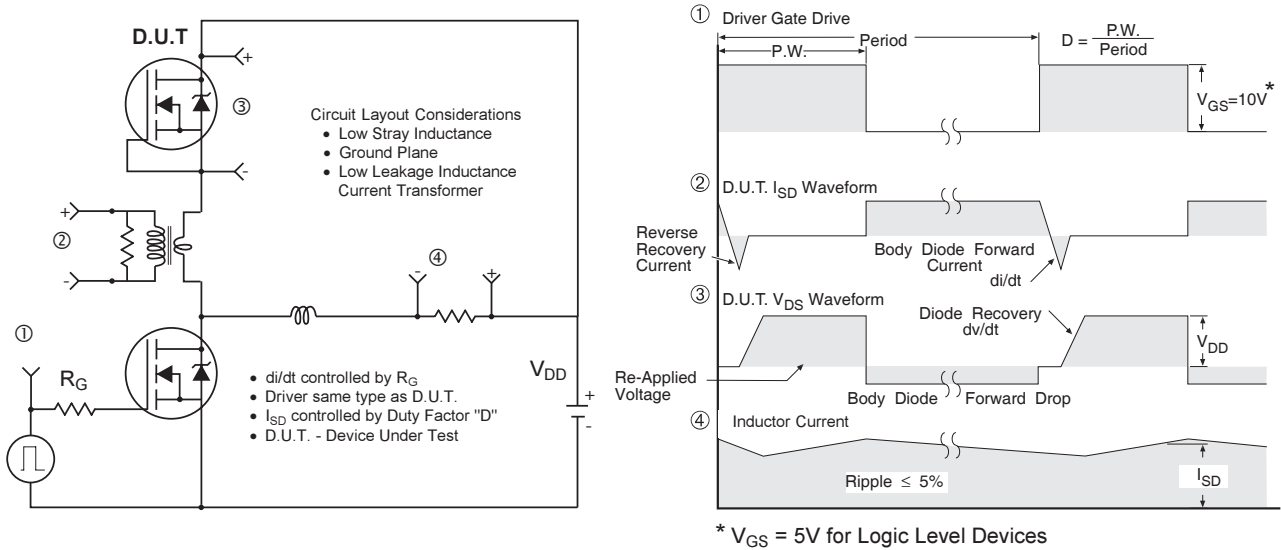
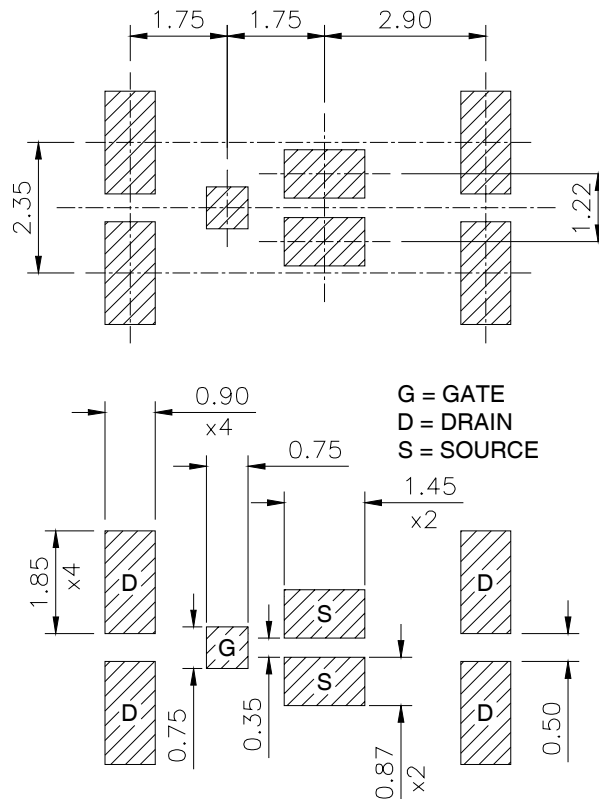


Fig 16. Diode Reverse Recovery Test Circuit for N-Channel HEXFET® Power MOSFETs

DirectFET™ Substrate and PCB Layout, MX Outline (Medium Size Can, X-Designation).

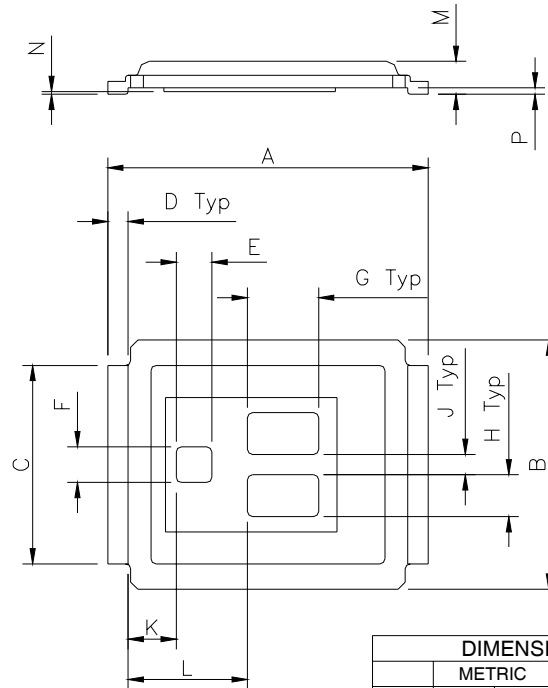
Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET.

This includes all recommendations for stencil and substrate designs.



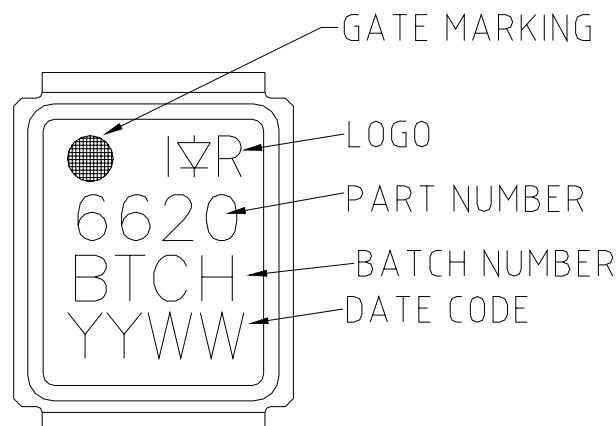
**DirectFET™ Outline Dimension, MX Outline
 (Medium Size Can, X-Designation).**

Please see DirectFET application note AN-1035 for all details regarding the assembly of DirectFET. This includes all recommendations for stencil and substrate designs.



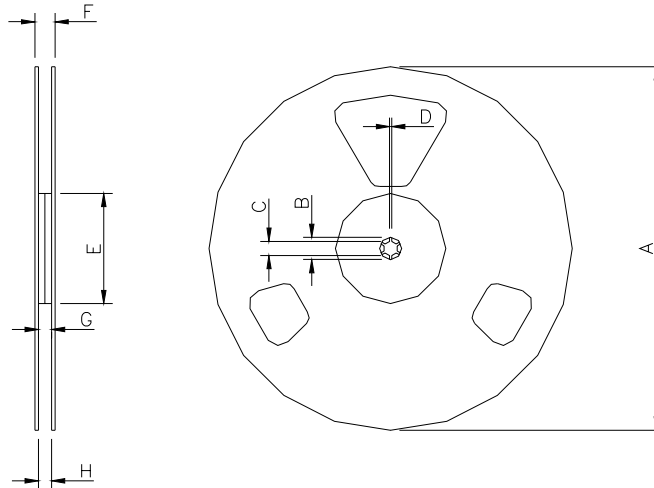
| CODE | METRIC | | IMPERIAL | |
|------|--------|------|----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 6.25 | 6.35 | 0.246 | 0.250 |
| B | 4.80 | 5.05 | 0.189 | 0.201 |
| C | 3.85 | 3.95 | 0.152 | 0.156 |
| D | 0.35 | 0.45 | 0.014 | 0.018 |
| E | 0.68 | 0.72 | 0.027 | 0.028 |
| F | 0.68 | 0.72 | 0.027 | 0.028 |
| G | 1.38 | 1.42 | 0.054 | 0.056 |
| H | 0.80 | 0.84 | 0.032 | 0.033 |
| J | 0.38 | 0.42 | 0.015 | 0.017 |
| K | 0.88 | 1.01 | 0.035 | 0.039 |
| L | 2.28 | 2.41 | 0.090 | 0.095 |
| M | 0.59 | 0.70 | 0.023 | 0.028 |
| N | 0.03 | 0.08 | 0.001 | 0.003 |
| P | 0.08 | 0.17 | 0.003 | 0.007 |

DirectFET™ Part Marking



IRF6620

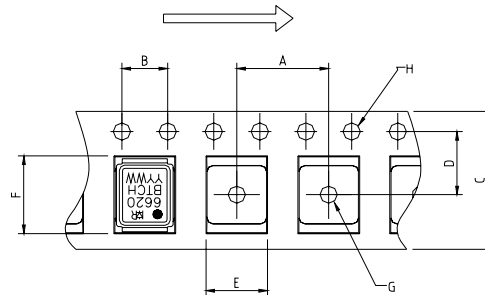
DirectFET™ Tape & Reel Dimension (Showing component orientation).



NOTE: Controlling dimensions in mm
Std reel quantity is 4800 parts. (ordered as IRF6620). For 1000 parts on 7" reel, order IRF6620TR1

| REEL DIMENSIONS | | | | | | | | |
|----------------------------|--------|------|----------|-------|-----------------------|-------|----------|------|
| STANDARD OPTION (QTY 4800) | | | | | TR1 OPTION (QTY 1000) | | | |
| CODE | METRIC | | IMPERIAL | | METRIC | | IMPERIAL | |
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| A | 330.0 | N.C | 12.992 | N.C | 177.77 | N.C | 6.9 | N.C |
| B | 20.2 | N.C | 0.795 | N.C | 19.06 | N.C | 0.75 | N.C |
| C | 12.8 | 13.2 | 0.504 | 0.520 | 13.5 | 12.8 | 0.53 | 0.50 |
| D | 1.5 | N.C | 0.059 | N.C | 1.5 | N.C | 0.059 | N.C |
| E | 100.0 | N.C | 3.937 | N.C | 58.72 | N.C | 2.31 | N.C |
| F | N.C | 18.4 | N.C | 0.724 | N.C | 13.50 | N.C | 0.53 |
| G | 12.4 | 14.4 | 0.488 | 0.567 | 11.9 | 12.01 | 0.47 | N.C |
| H | 11.9 | 15.4 | 0.469 | 0.606 | 11.9 | 12.01 | 0.47 | N.C |

LOADED TAPE FEED DIRECTION



NOTE: CONTROLLING DIMENSIONS IN MM

| CODE | METRIC | | IMPERIAL | |
|------|--------|-------|----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 7.90 | 8.10 | 0.311 | 0.319 |
| B | 3.90 | 4.10 | 0.154 | 0.161 |
| C | 11.90 | 12.30 | 0.469 | 0.484 |
| D | 5.45 | 5.55 | 0.215 | 0.219 |
| E | 5.10 | 5.30 | 0.201 | 0.209 |
| F | 6.50 | 6.70 | 0.256 | 0.264 |
| G | 1.50 | N.C | 0.059 | N.C |
| H | 1.50 | 1.60 | 0.059 | 0.063 |

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

Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>