

# IRF5852

HEXFET® Power MOSFET

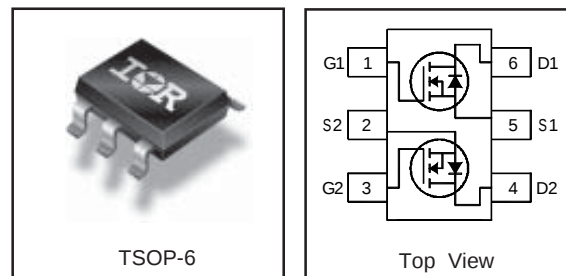
- Ultra Low On-Resistance
- Dual N-Channel MOSFET
- Surface Mount
- Available in Tape & Reel
- Low Gate Charge

| $V_{DS}$ | $R_{DS(on)}$ max ( $\Omega$ ) | $I_D$ |
|----------|-------------------------------|-------|
| 20 V     | 0.090@ $V_{GS} = 4.5V$        | 2.7A  |
|          | 0.120@ $V_{GS} = 2.5V$        | 2.2A  |

## Description

These N-channel MOSFETs from International Rectifier utilize advanced processing techniques to achieve the extremely low on-resistance per silicon area. This benefit provides the designer with an extremely efficient device for use in battery and load management applications.

This Dual TSOP-6 package is ideal for applications where printed circuit board space is at a premium and where maximum functionality is required. With two die per package, the IRF5852 can provide the functionality of two SOT-23 packages in a smaller footprint. Its unique thermal design and  $R_{DS(on)}$  reduction enables an increase in current-handling capability.



## Absolute Maximum Ratings

|                          | Parameter                                 | Max.         | Units |
|--------------------------|-------------------------------------------|--------------|-------|
| $V_{DS}$                 | Drain- Source Voltage                     | 20           | V     |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current, $V_{GS} @ 4.5V$ | 2.7          | A     |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current, $V_{GS} @ 4.5V$ | 2.2          |       |
| $I_{DM}$                 | Pulsed Drain Current ①                    | 11           |       |
| $P_D @ T_A = 25^\circ C$ | Power Dissipation ③                       | 0.96         | W     |
| $P_D @ T_A = 70^\circ C$ | Power Dissipation ③                       | 0.62         |       |
|                          | Linear Derating Factor                    | 7.7          | mW/°C |
| $V_{GS}$                 | Gate-to-Source Voltage                    | $\pm 12$     | V     |
| $T_J, T_{STG}$           | Junction and Storage Temperature Range    | -55 to + 150 | °C    |

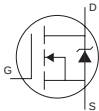
## Thermal Resistance

|                 | Parameter                     | Max. | Units |
|-----------------|-------------------------------|------|-------|
| $R_{\theta JA}$ | Maximum Junction-to-Ambient ③ | 130  | °C/W  |

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

|                                 | Parameter                            | Min. | Typ.  | Max.  | Units               | Conditions                                                |
|---------------------------------|--------------------------------------|------|-------|-------|---------------------|-----------------------------------------------------------|
| $V_{(BR)DSS}$                   | Drain-to-Source Breakdown Voltage    | 20   | —     | —     | V                   | $V_{GS} = 0V$ , $I_D = 250\mu A$                          |
| $\Delta V_{(BR)DSS}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient  | —    | 0.016 | —     | V/ $^\circ\text{C}$ | Reference to $25^\circ\text{C}$ , $I_D = 1mA$             |
| $R_{DS(on)}$                    | Static Drain-to-Source On-Resistance | —    | —     | 0.090 | $\Omega$            | $V_{GS} = 4.5V$ , $I_D = 2.7A$ ②                          |
|                                 |                                      | —    | —     | 0.120 |                     | $V_{GS} = 2.5V$ , $I_D = 2.2A$ ②                          |
| $V_{GS(th)}$                    | Gate Threshold Voltage               | 0.60 | —     | 1.25  | V                   | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                      |
| $g_{fs}$                        | Forward Transconductance             | 5.2  | —     | —     | S                   | $V_{DS} = 10V$ , $I_D = 2.7A$                             |
| $I_{DSS}$                       | Drain-to-Source Leakage Current      | —    | —     | 1.0   | $\mu A$             | $V_{DS} = 16V$ , $V_{GS} = 0V$                            |
|                                 |                                      | —    | —     | 25    |                     | $V_{DS} = 16V$ , $V_{GS} = 0V$ , $T_J = 70^\circ\text{C}$ |
| $I_{GSS}$                       | Gate-to-Source Forward Leakage       | —    | —     | 100   | nA                  | $V_{GS} = 12V$                                            |
|                                 | Gate-to-Source Reverse Leakage       | —    | —     | -100  |                     | $V_{GS} = -12V$                                           |
| $Q_g$                           | Total Gate Charge                    | —    | 4.0   | 6.0   | nC                  | $I_D = 2.7A$                                              |
| $Q_{gs}$                        | Gate-to-Source Charge                | —    | 0.95  | —     |                     | $V_{DS} = 16V$                                            |
| $Q_{gd}$                        | Gate-to-Drain ("Miller") Charge      | —    | 0.88  | —     |                     | $V_{GS} = 4.5V$ ②                                         |
| $t_{d(on)}$                     | Turn-On Delay Time                   | —    | 6.6   | —     | ns                  | $V_{DD} = 10V$ ②                                          |
| $t_r$                           | Rise Time                            | —    | 1.2   | —     |                     | $I_D = 1.0A$                                              |
| $t_{d(off)}$                    | Turn-Off Delay Time                  | —    | 15    | —     |                     | $R_G = 6.2\Omega$                                         |
| $t_f$                           | Fall Time                            | —    | 2.4   | —     |                     | $V_{GS} = 4.5V$                                           |
| $C_{iss}$                       | Input Capacitance                    | —    | 400   | —     | pF                  | $V_{GS} = 0V$                                             |
| $C_{oss}$                       | Output Capacitance                   | —    | 48    | —     |                     | $V_{DS} = 15V$                                            |
| $C_{rss}$                       | Reverse Transfer Capacitance         | —    | 32    | —     |                     | $f = 1.0MHz$                                              |

## Source-Drain Ratings and Characteristics

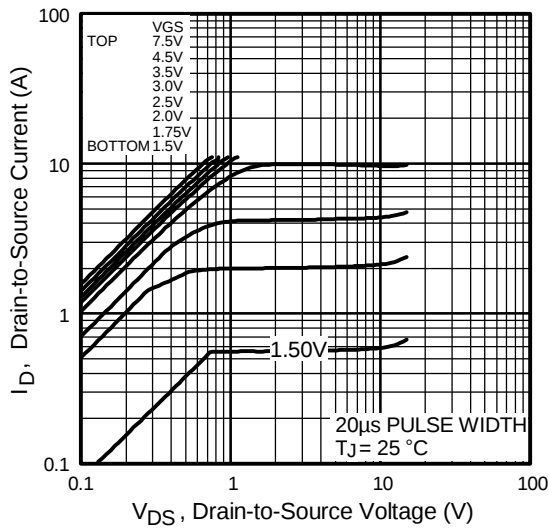
|          | Parameter                              | Min. | Typ. | Max. | Units | Conditions                                                                                                                                           |
|----------|----------------------------------------|------|------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| $I_S$    | Continuous Source Current (Body Diode) | —    | —    | 0.96 | A     | MOSFET symbol showing the integral reverse p-n junction diode.  |
| $I_{SM}$ | Pulsed Source Current (Body Diode) ①   | —    | —    | 11   |       |                                                                                                                                                      |
| $V_{SD}$ | Diode Forward Voltage                  | —    | —    | 1.2  | V     | $T_J = 25^\circ\text{C}$ , $I_S = 0.96A$ , $V_{GS} = 0V$ ②                                                                                           |
| $t_{rr}$ | Reverse Recovery Time                  | —    | 25   | 38   | ns    | $T_J = 25^\circ\text{C}$ , $I_F = 0.96A$                                                                                                             |
| $Q_{rr}$ | Reverse Recovery Charge                | —    | 6.5  | 9.8  | nC    | $di/dt = 100A/\mu s$ ②                                                                                                                               |

### Notes:

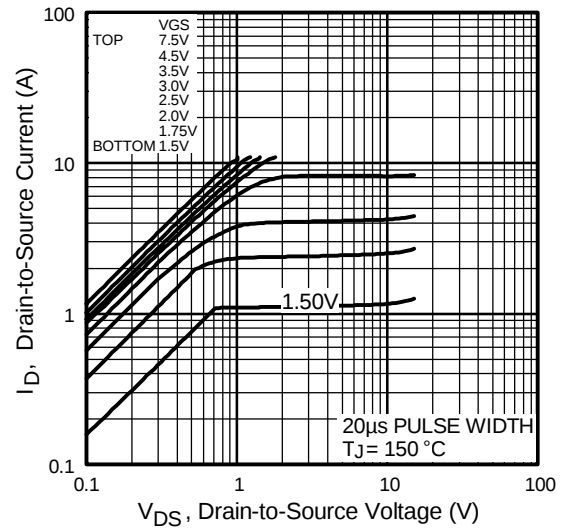
① Repetitive rating; pulse width limited by max. junction temperature.

③ Surface mounted on FR-4 board,  $t \leq 5sec$ .

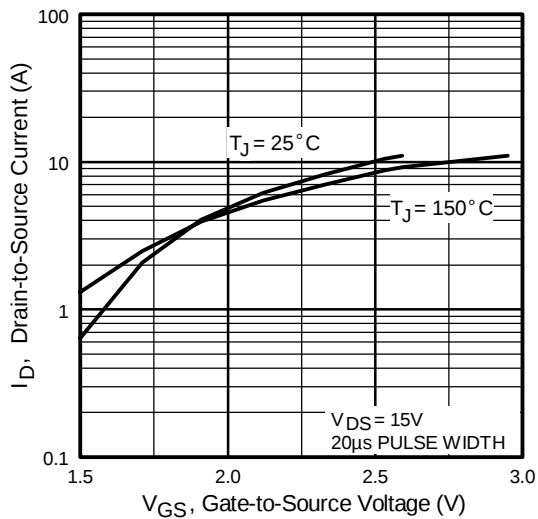
② Pulse width  $\leq 400\mu s$ ; duty cycle  $\leq 2\%$ .



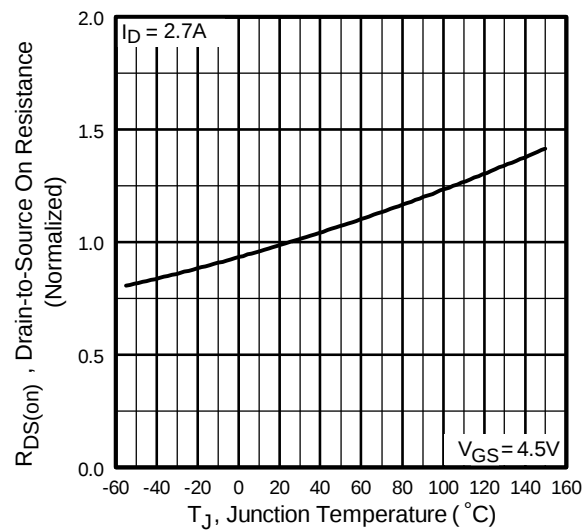
**Fig 1.** Typical Output Characteristics



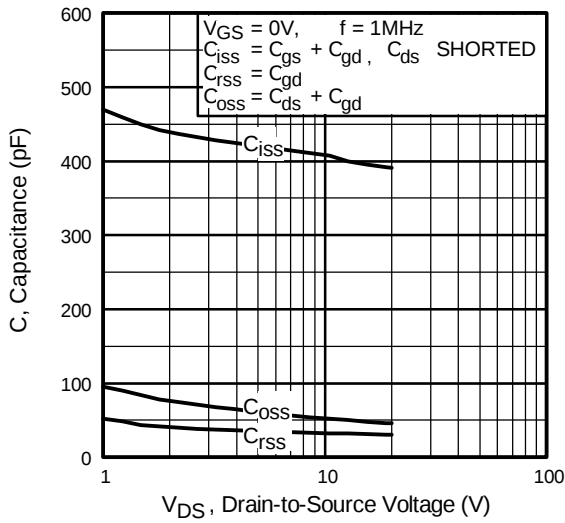
**Fig 2.** Typical Output Characteristics



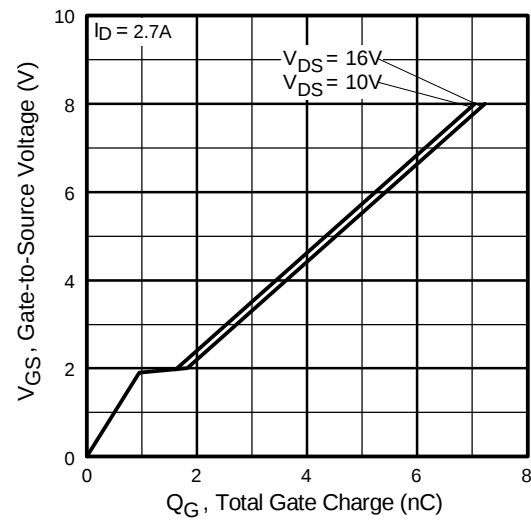
**Fig 3.** Typical Transfer Characteristics



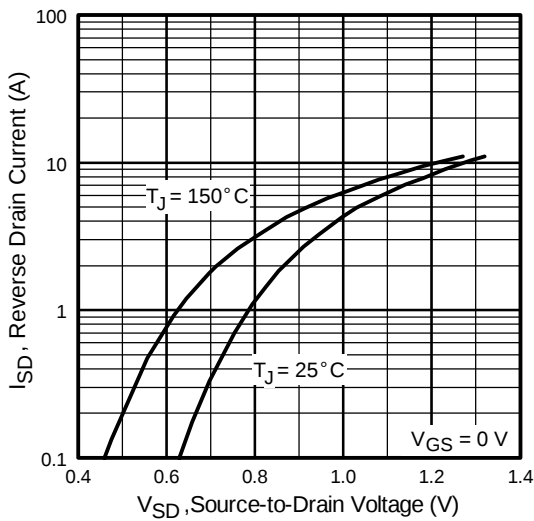
**Fig 4.** Normalized On-Resistance Vs. Temperature



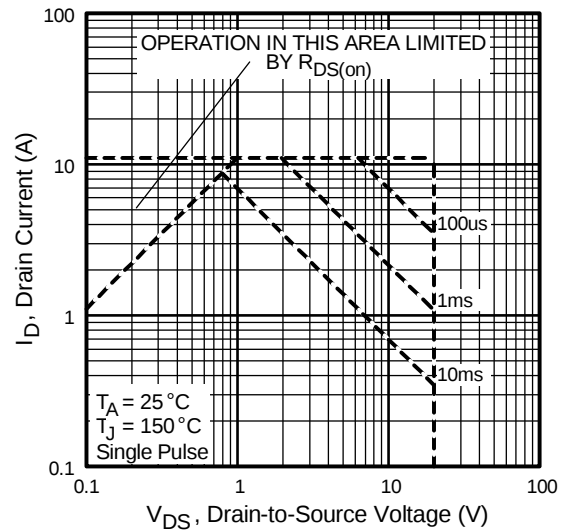
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



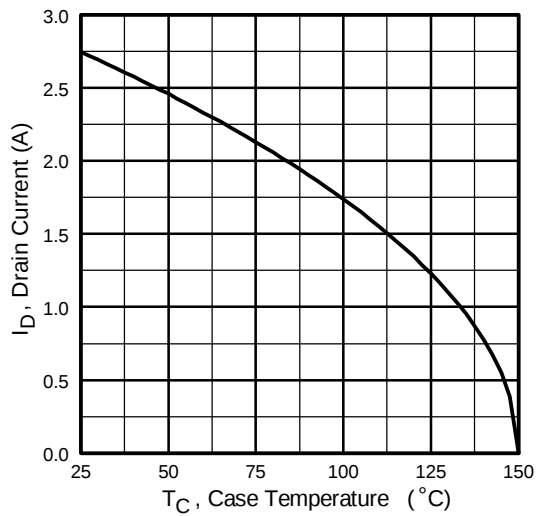
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



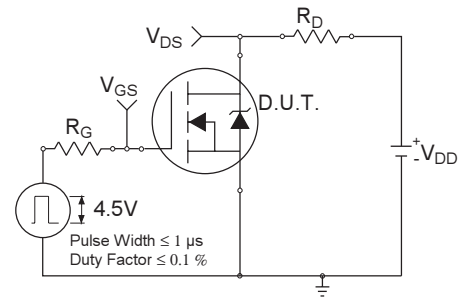
**Fig 7.** Typical Source-Drain Diode Forward Voltage



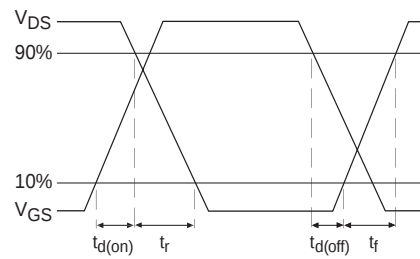
**Fig 8.** Maximum Safe Operating Area



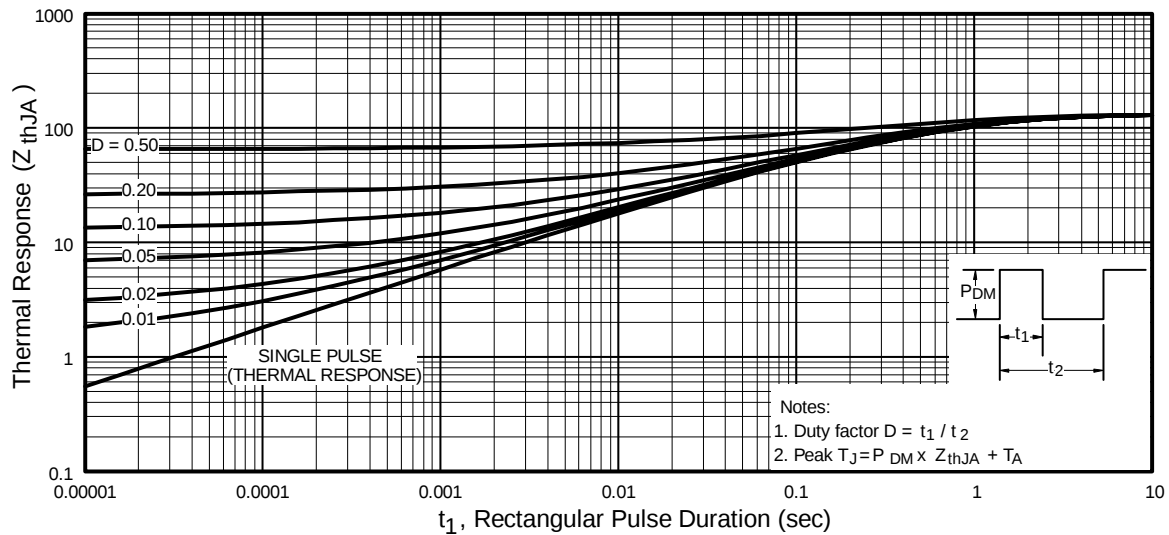
**Fig 9.** Maximum Drain Current Vs. Case Temperature



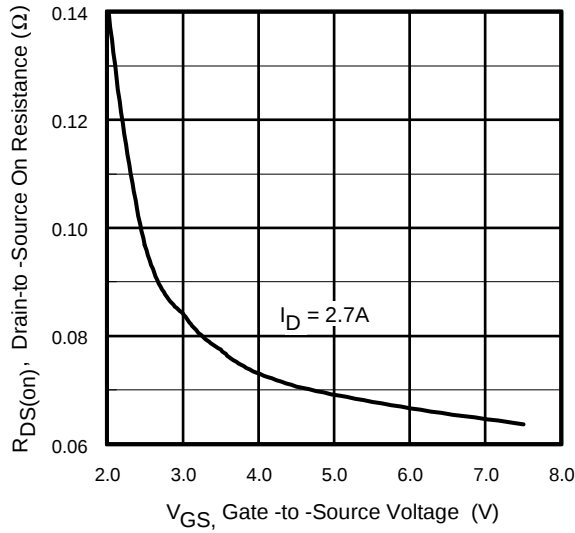
**Fig 10a.** Switching Time Test Circuit



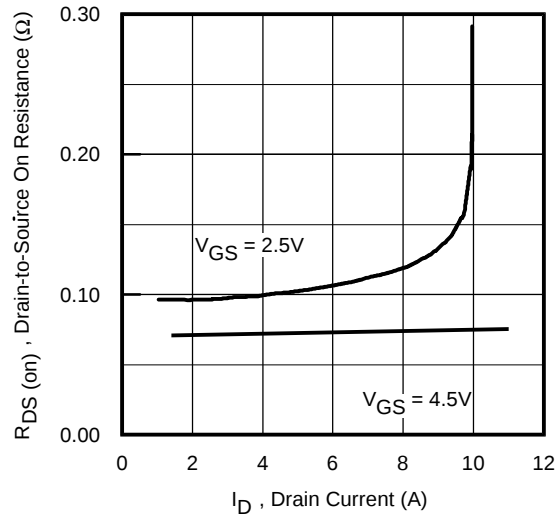
**Fig 10b.** Switching Time Waveforms



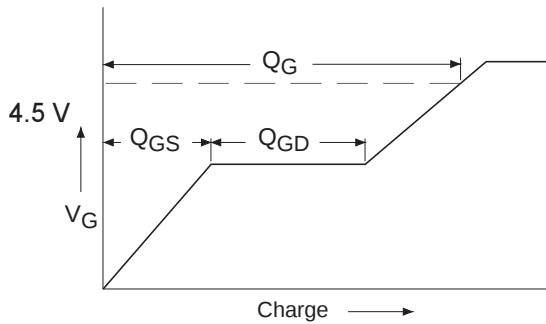
**Fig 10.** Typical Effective Transient Thermal Impedance, Junction-to-Ambient



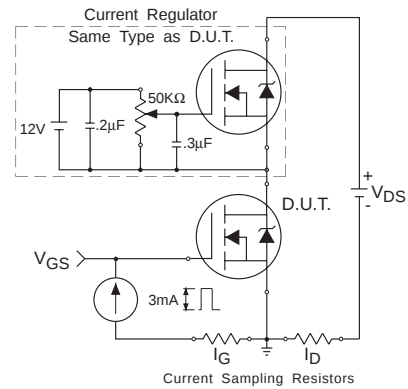
**Fig 11.** Typical On-Resistance Vs. Gate Voltage



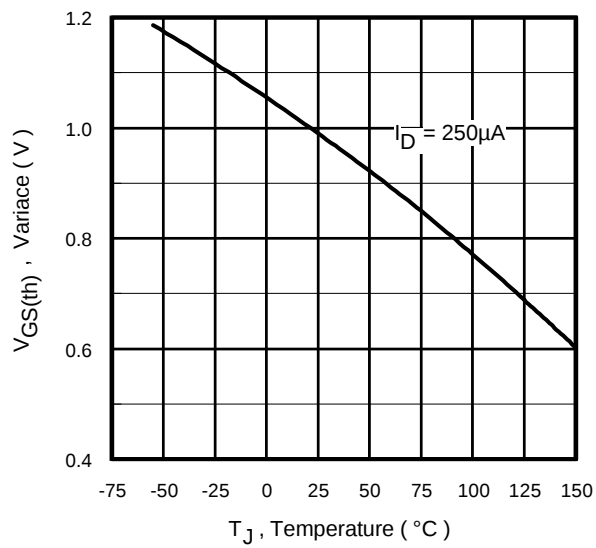
**Fig 12.** Typical On-Resistance Vs. Drain Current



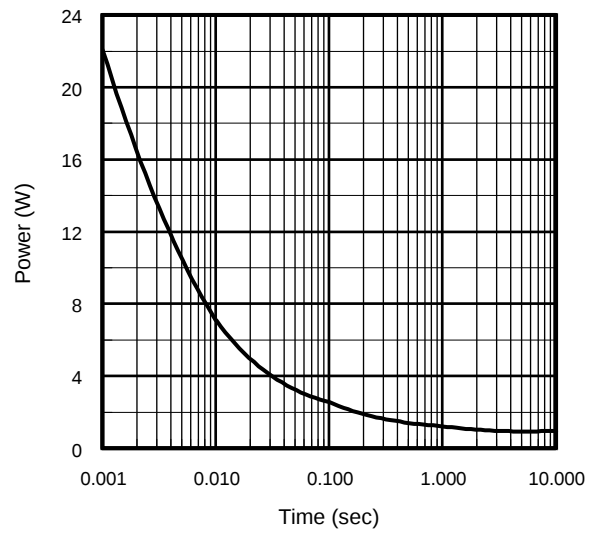
**Fig 13a.** Basic Gate Charge Waveform



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



**Fig 14.** Threshold Voltage Vs. Temperature

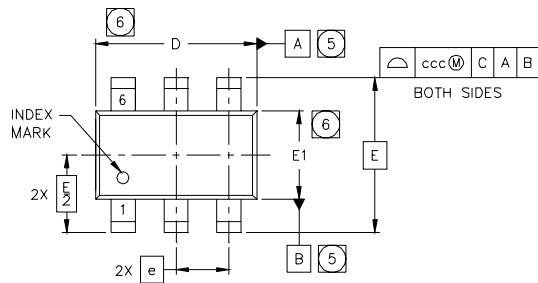


**Fig 15.** Typical Power Vs. Time

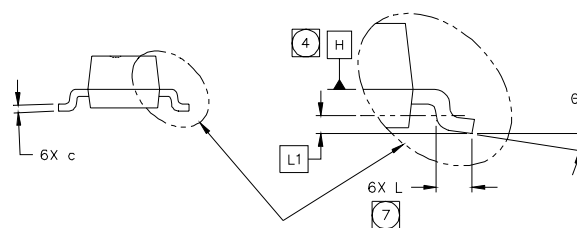
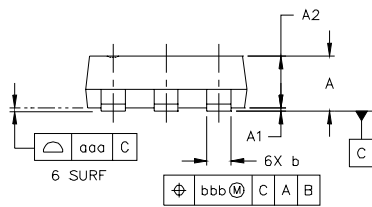
# IRF5852

International  
**IR** Rectifier

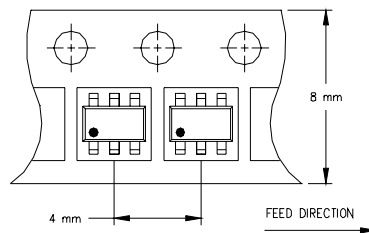
## TSOP-6 Package Outline



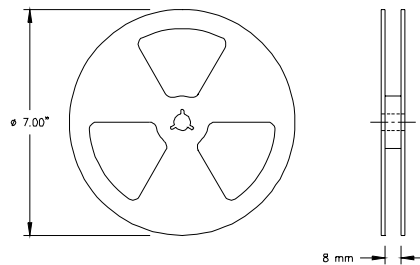
| SYMBOL | MO-193AA DIMENSIONS |      |      |           |       |       |
|--------|---------------------|------|------|-----------|-------|-------|
|        | MILLIMETERS         |      |      | INCHES    |       |       |
|        | MIN                 | NOM  | MAX  | MIN       | NOM   | MAX   |
| A      | ---                 | ---  | 1.10 | ---       | ---   | .0433 |
| A1     | 0.01                | ---  | 0.10 | .0004     | ---   | .0039 |
| A2     | 0.80                | 0.90 | 1.00 | .0315     | .0354 | .0393 |
| b      | 0.25                | ---  | 0.50 | .0099     | ---   | .0196 |
| c      | 0.10                | ---  | 0.26 | .004      | ---   | .010  |
| D      | 2.90                | 3.00 | 3.10 | .115      | .118  | .122  |
| E      | 2.75 BSC            |      |      | .108 BSC  |       |       |
| E1     | 1.30                | 1.50 | 1.70 | .052      | .059  | .066  |
| e      | 1.00 BSC            |      |      | .039 BSC  |       |       |
| L      | 0.20                | 0.40 | 0.60 | .0079     | .0157 | .0236 |
| L1     | 0.30 BSC            |      |      | .0118 BSC |       |       |
| θ      | 0°                  | ---  | 8°   | 0°        | ---   | 8°    |
| aaa    | 0.10                |      |      | .004      |       |       |
| bbb    | 0.15                |      |      | .006      |       |       |
| ccc    | 0.25                |      |      | .010      |       |       |



## TSOP-6 Tape & Reel Information



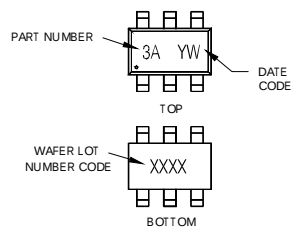
NOTES:  
1. OUTLINE CONFORMS TO EIA-481 & EIA-541.



NOTES:  
1. OUTLINE CONFORMS TO EIA-481 & EIA-541.

## TSOP-6 Part Marking Information

Notes: This part marking information applies to devices produced before 02/26/2001  
EXAMPLE: THIS IS AN S13443DV WW = (1-26) IF PRECEDED BY LAST DIGIT OF CALENDAR YEAR



PART NUMBER CODE REFERENCE:

3A = S13443DV  
3B = IRF5800  
3C = IRF5850  
3D = IRF5851  
3E = IRF5852  
3I = IRF5805  
3J = IRF5806

DATE CODE EXAMPLES:

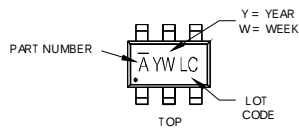
YWW = 9603 = 6C  
YWW = 9632 = FF

| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | 1 | 01        | A |
| 2002 | 2 | 02        | B |
| 2003 | 3 | 03        | C |
| 2004 | 4 | 04        | D |
| 2005 | 5 |           |   |
| 1996 | 6 |           |   |
| 1997 | 7 |           |   |
| 1998 | 8 |           |   |
| 1999 | 9 |           |   |
| 2000 | 0 | 24        | X |
|      |   | 25        | Y |
|      |   | 26        | Z |

WW = (27-52) IF PRECEDED BY A LETTER

| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | A | 27        | A |
| 2002 | B | 28        | B |
| 2003 | C | 29        | C |
| 2004 | D | 30        | D |
| 2005 | E |           |   |
| 1996 | F |           |   |
| 1997 | G |           |   |
| 1998 | H |           |   |
| 1999 | J |           |   |
| 2000 | K | 50        | X |
|      |   | 51        | Y |
|      |   | 52        | Z |

Notes: This part marking information applies to devices produced after 02/26/2001  
W = (1-26) IF PRECEDED BY LAST DIGIT OF CALENDAR YEAR



PART NUMBER CODE REFERENCE:

A = S13443DV  
B = IRF5800  
C = IRF5850  
D = IRF5851  
E = IRF5852  
I = IRF5805  
J = IRF5806  
K = IRF5810  
L = IRF5804  
M = IRF5803  
N = IRF5820

W = (27-52) IF PRECEDED BY A LETTER

| YEAR | Y | WORK WEEK | W |
|------|---|-----------|---|
| 2001 | A | 27        | A |
| 2002 | B | 28        | B |
| 2003 | C | 29        | C |
| 2004 | D | 30        | D |
| 2005 | E |           |   |
| 1996 | F |           |   |
| 1997 | G |           |   |
| 1998 | H |           |   |
| 1999 | J |           |   |
| 2000 | K | 50        | X |
|      |   | 51        | Y |
|      |   | 52        | Z |

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.

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