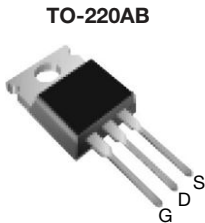


## Power MOSFET

| PRODUCT SUMMARY           |                             |
|---------------------------|-----------------------------|
| $V_{DS}$ (V)              | 100                         |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10\text{ V}$ 0.16 |
| $Q_g$ (Max.) (nC)         | 26                          |
| $Q_{gs}$ (nC)             | 5.5                         |
| $Q_{gd}$ (nC)             | 11                          |
| Configuration             | Single                      |



### FEATURES

- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Compliant to RoHS Directive 2002/95/EC



### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The TO-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.

| ORDERING INFORMATION |            |
|----------------------|------------|
| Package              | TO-220AB   |
| Lead (Pb)-free       | IRF530PbF  |
|                      | SiHF530-E3 |
| SnPb                 | IRF530     |
|                      | SiHF530    |



| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                                  |                |                                   |                     |   |
|---------------------------------------------------------------------------------------|----------------------------------|----------------|-----------------------------------|---------------------|---|
| PARAMETER                                                                             |                                  | SYMBOL         | LIMIT                             | UNIT                |   |
| Drain-Source Voltage                                                                  |                                  | $V_{DS}$       | 100                               | V                   |   |
| Gate-Source Voltage                                                                   |                                  | $V_{GS}$       | $\pm 20$                          |                     |   |
| Continuous Drain Current                                                              | $V_{GS}$ at 10 V                 | $I_D$          | $T_C = 25\text{ }^\circ\text{C}$  | 14                  | A |
|                                                                                       |                                  |                | $T_C = 100\text{ }^\circ\text{C}$ | 10                  |   |
| Pulsed Drain Current <sup>a</sup>                                                     |                                  | $I_{DM}$       | 56                                |                     |   |
| Linear Derating Factor                                                                |                                  |                | 0.59                              | W/ $^\circ\text{C}$ |   |
| Single Pulse Avalanche Energy <sup>b</sup>                                            |                                  | $E_{AS}$       | 69                                | mJ                  |   |
| Repetitive Avalanche Current <sup>a</sup>                                             |                                  | $I_{AR}$       | 14                                | A                   |   |
| Repetitive Avalanche Energy <sup>a</sup>                                              |                                  | $E_{AR}$       | 8.8                               | mJ                  |   |
| Maximum Power Dissipation                                                             | $T_C = 25\text{ }^\circ\text{C}$ | $P_D$          | 88                                | W                   |   |
| Peak Diode Recovery $dV/dt^c$                                                         |                                  | $dV/dt$        | 5.5                               | V/ns                |   |
| Operating Junction and Storage Temperature Range                                      |                                  | $T_J, T_{stg}$ | - 55 to + 175                     | $^\circ\text{C}$    |   |
| Soldering Recommendations (Peak Temperature)                                          | for 10 s                         |                | 300 <sup>d</sup>                  |                     |   |
| Mounting Torque                                                                       | 6-32 or M3 screw                 |                | 10                                | lbf · in            |   |
|                                                                                       |                                  |                | 1.1                               | N · m               |   |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25\text{ V}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 528\text{ }\mu\text{H}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 14\text{ A}$  (see fig. 12).
- $I_{SD} \leq 14\text{ A}$ ,  $dI/dt \leq 140\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175\text{ }^\circ\text{C}$ .
- 1.6 mm from case.

\* Pb containing terminations are not RoHS compliant, exemptions may apply

| THERMAL RESISTANCE RATINGS          |            |      |      |      |
|-------------------------------------|------------|------|------|------|
| PARAMETER                           | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient         | $R_{thJA}$ | -    | 62   | °C/W |
| Case-to-Sink, Flat, Greased Surface | $R_{thCS}$ | 0.50 | -    |      |
| Maximum Junction-to-Case (Drain)    | $R_{thJC}$ | -    | 1.7  |      |

| SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted) |                     |                                                                                                                                                                 |      |      |           |               |
|-----------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-----------|---------------|
| PARAMETER                                                                   | SYMBOL              | TEST CONDITIONS                                                                                                                                                 | MIN. | TYP. | MAX.      | UNIT          |
| <b>Static</b>                                                               |                     |                                                                                                                                                                 |      |      |           |               |
| Drain-Source Breakdown Voltage                                              | $V_{DS}$            | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                                                                                                             | 100  | -    | -         | V             |
| $V_{DS}$ Temperature Coefficient                                            | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$ , $I_D = 1\text{ mA}$                                                                                                   | -    | 0.12 | -         | V/°C          |
| Gate-Source Threshold Voltage                                               | $V_{GS(th)}$        | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                                                                                 | 2.0  | -    | 4.0       | V             |
| Gate-Source Leakage                                                         | $I_{GSS}$           | $V_{GS} = \pm 20\text{ V}$                                                                                                                                      | -    | -    | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current                                             | $I_{DSS}$           | $V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$                                                                                                                    | -    | -    | 25        | $\mu\text{A}$ |
|                                                                             |                     | $V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$                                                                                    | -    | -    | 250       |               |
| Drain-Source On-State Resistance                                            | $R_{DS(on)}$        | $V_{GS} = 10\text{ V}, I_D = 8.4\text{ A}^b$                                                                                                                    | -    | -    | 0.16      | $\Omega$      |
| Forward Transconductance                                                    | $g_{fs}$            | $V_{DS} = 50\text{ V}, I_D = 8.4\text{ A}^b$                                                                                                                    | 5.1  | -    | -         | S             |
| <b>Dynamic</b>                                                              |                     |                                                                                                                                                                 |      |      |           |               |
| Input Capacitance                                                           | $C_{iss}$           | $V_{GS} = 0\text{ V},$<br>$V_{DS} = 25\text{ V},$<br>$f = 1.0\text{ MHz},$ see fig. 5                                                                           | -    | 670  | -         | pF            |
| Output Capacitance                                                          | $C_{oss}$           |                                                                                                                                                                 | -    | 250  | -         |               |
| Reverse Transfer Capacitance                                                | $C_{rss}$           |                                                                                                                                                                 | -    | 60   | -         |               |
| Total Gate Charge                                                           | $Q_g$               | $V_{GS} = 10\text{ V},$<br>$I_D = 14\text{ A}, V_{DS} = 80\text{ V},$<br>see fig. 6 and 13 <sup>b</sup>                                                         | -    | -    | 26        | nC            |
| Gate-Source Charge                                                          | $Q_{gs}$            |                                                                                                                                                                 | -    | -    | 5.5       |               |
| Gate-Drain Charge                                                           | $Q_{gd}$            |                                                                                                                                                                 | -    | -    | 11        |               |
| Turn-On Delay Time                                                          | $t_{d(on)}$         | $V_{DD} = 50\text{ V}, I_D = 14\text{ A},$<br>$R_g = 12\text{ }\Omega, R_D = 3.6\text{ }\Omega,$ see fig. 10 <sup>b</sup>                                       | -    | 10   | -         | ns            |
| Rise Time                                                                   | $t_r$               |                                                                                                                                                                 | -    | 34   | -         |               |
| Turn-Off Delay Time                                                         | $t_{d(off)}$        |                                                                                                                                                                 | -    | 23   | -         |               |
| Fall Time                                                                   | $t_f$               |                                                                                                                                                                 | -    | 24   | -         |               |
| Internal Drain Inductance                                                   | $L_D$               | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact  | -    | 4.5  | -         | nH            |
| Internal Source Inductance                                                  | $L_S$               |                                                                                                                                                                 | -    | 7.5  | -         |               |
| <b>Drain-Source Body Diode Characteristics</b>                              |                     |                                                                                                                                                                 |      |      |           |               |
| Continuous Source-Drain Diode Current                                       | $I_S$               | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode    | -    | -    | 14        | A             |
| Pulsed Diode Forward Current <sup>a</sup>                                   | $I_{SM}$            |                                                                                                                                                                 | -    | -    | 56        |               |
| Body Diode Voltage                                                          | $V_{SD}$            | $T_J = 25\text{ }^\circ\text{C}, I_S = 14\text{ A}, V_{GS} = 0\text{ V}^b$                                                                                      | -    | -    | 2.5       | V             |
| Body Diode Reverse Recovery Time                                            | $t_{rr}$            | $T_J = 25\text{ }^\circ\text{C}, I_F = 14\text{ A}, di/dt = 100\text{ A}/\mu\text{s}^b$                                                                         | -    | 150  | 280       | ns            |
| Body Diode Reverse Recovery Charge                                          | $Q_{rr}$            |                                                                                                                                                                 | -    | 0.85 | 1.7       | $\mu\text{C}$ |
| Forward Turn-On Time                                                        | $t_{on}$            | Intrinsic turn-on time is negligible (turn-on is dominated by $L_S$ and $L_D$ )                                                                                 |      |      |           |               |

**Notes**

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Fig. 1 - Typical Output Characteristics,  $T_C = 25\text{ }^\circ\text{C}$** 

**Fig. 3 - Typical Transfer Characteristics**

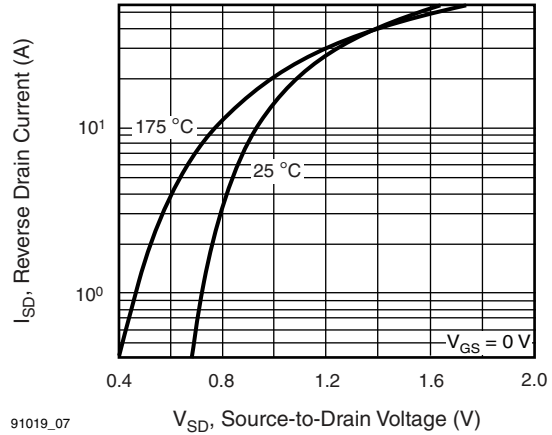
**Fig. 2 - Typical Output Characteristics,  $T_C = 175\text{ }^\circ\text{C}$** 

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



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



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



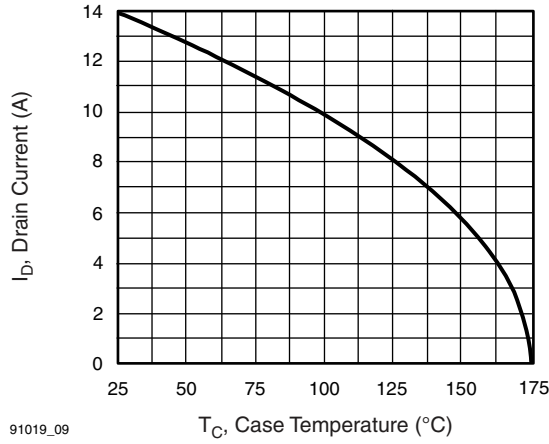
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**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



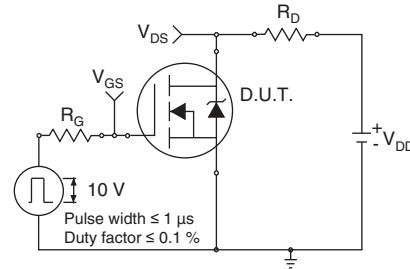
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**Fig. 8 - Maximum Safe Operating Area**

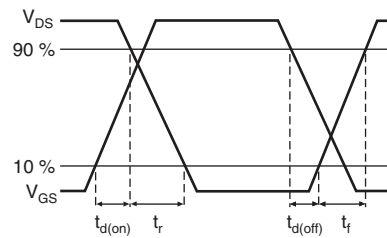


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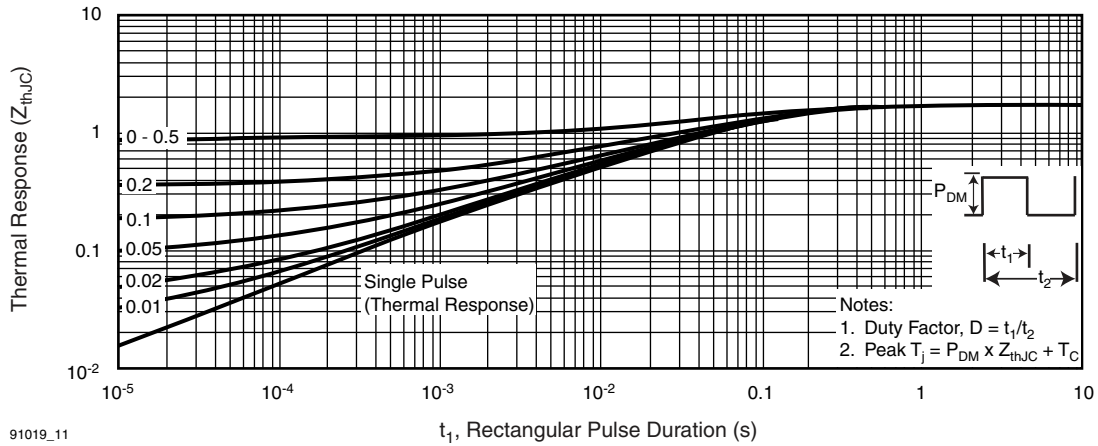
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



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



**Fig. 10b - Switching Time Waveforms**



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



Fig. 12a - Unclamped Inductive Test Circuit

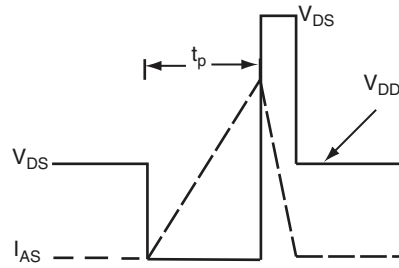
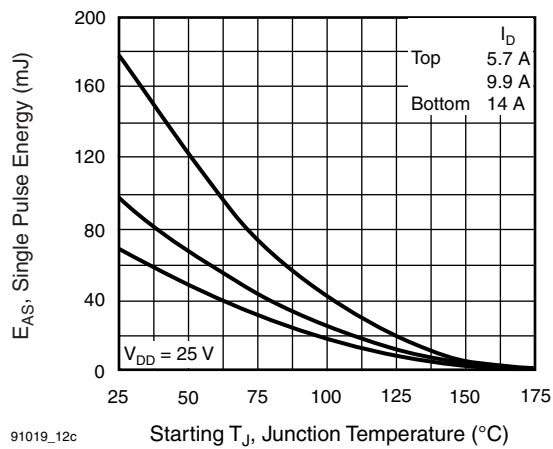


Fig. 12b - Unclamped Inductive Waveforms



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Fig. 12c - Maximum Avalanche Energy vs. Drain Current

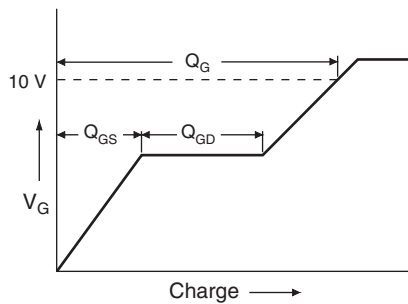


Fig. 13a - Basic Gate Charge Waveform

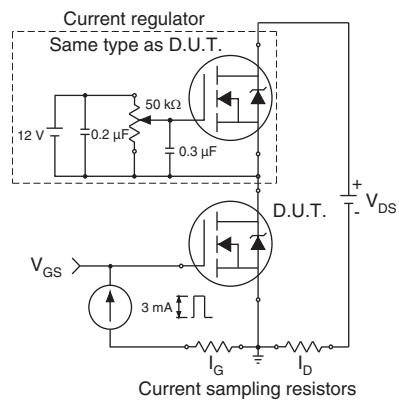


Fig. 13b - Gate Charge Test Circuit

**Peak Diode Recovery dV/dt Test Circuit**

**Note**

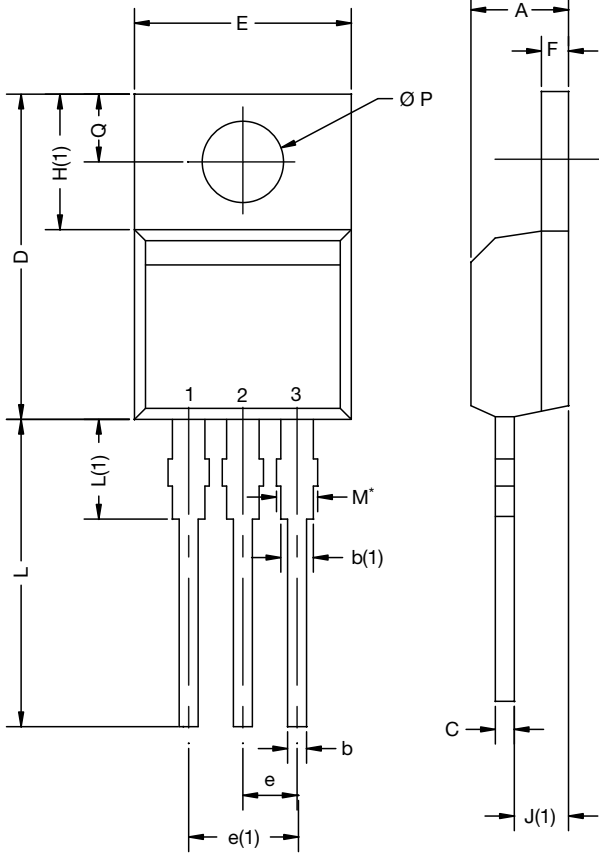
 a.  $V_{GS} = 5\text{ V}$  for logic level devices

**Fig. 14 - For N-Channel**

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TO-220-1



| DIM. | MILLIMETERS |       | INCHES |       |
|------|-------------|-------|--------|-------|
|      | MIN.        | MAX.  | MIN.   | MAX.  |
| A    | 4.14        | 4.70  | 0.163  | 0.185 |
| b    | 0.69        | 1.02  | 0.027  | 0.040 |
| b(1) | 1.14        | 1.73  | 0.045  | 0.068 |
| c    | 0.36        | 0.61  | 0.014  | 0.024 |
| D    | 14.33       | 15.85 | 0.564  | 0.624 |
| E    | 9.96        | 10.52 | 0.392  | 0.414 |
| e    | 2.41        | 2.67  | 0.095  | 0.105 |
| e(1) | 4.88        | 5.28  | 0.192  | 0.208 |
| F    | 0.43        | 1.40  | 0.017  | 0.055 |
| H(1) | 6.10        | 6.48  | 0.240  | 0.255 |
| J(1) | 2.41        | 2.92  | 0.095  | 0.115 |
| L    | 13.36       | 14.40 | 0.526  | 0.567 |
| L(1) | 3.33        | 4.04  | 0.131  | 0.159 |
| Ø P  | 3.53        | 3.94  | 0.139  | 0.155 |
| Q    | 2.59        | 3.00  | 0.102  | 0.118 |

ECN: X15-0003-Rev. A, 19-Jan-15  
DWG: 6031

Notes

- M\* = 0.052 inches to 0.064 inches (dimension including protrusion), heatsink hole for HVM
- Outline conforms to JEDEC® outline TO-220AB with exception of dimension F







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