



P-Channel 30-V (D-S) MOSFET

| PRODUCT SUMMARY | | | | | | |
|---------------------|--|---------------------------------|-----------------------|--|--|--|
| V _{DS} (V) | $R_{DS(on)}\left(\Omega\right)$ | I _D (A) ^d | Q _g (Typ.) | | | |
| - 30 | 0.005 at V _{GS} = - 10 V | - 29 | 61 nC | | | |
| - 30 | 0.00775 at $V_{GS} = -4.5 \text{ V}$ | - 23 | | | | |

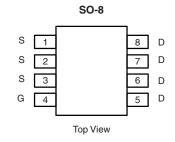
FEATURES

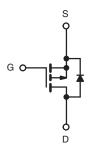
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_a and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- Adaptor Switch
- Notebook





Ordering Information: Si4459ADY-T1-GE3 (Lead (Pb)-free and Halogen-free)

P-Channel MOSFET

| Parameter | Symbol | Limit | Unit | |
|---|-----------------------------------|-----------------|------------------------|----|
| Drain-Source Voltage | V _{DS} | - 30 | V | |
| Gate-Source Voltage | V _{GS} | ± 20 | v | |
| | T _C = 25 °C | | - 29 | |
| Continuous Drain Current (T _{.1} = 150 °C) | T _C = 70 °C | | - 23.5 | |
| Continuous Diain Current (1) = 150 °C) | T _A = 25 °C | I _D | - 19.7 ^{a, b} | |
| | T _A = 70 °C | | - 15.6 ^{a, b} | ^ |
| Pulsed Drain Current | I _{DM} | - 70 | A | |
| Continuous Course Dunin Riada Courset | T _C = 25 °C | _ | - 6.5 | |
| Continuous Source-Drain Diode Current | T _A = 25 °C | I _S | - 2.9 ^{a, b} | |
| Avalanche Current | 1 04 mil | I _{AS} | - 30 | |
| Single-Pulse Avalanche Energy | L = 0.1 mH | E _{AS} | 45 | mJ |
| | T _C = 25 °C | | 7.8 | |
| Maximum Dawar Dissination | T _C = 70 °C | ь — | 5 | w |
| Maximum Power Dissipation | T _A = 25 °C | P _D | 3.5 ^{a, b} | VV |
| | T _A = 70 °C | | 2.2 ^{a, b} | |
| Operating Junction and Storage Temperature Rang | T _J , T _{stq} | - 55 to 150 | °C | |

| THERMAL RESISTANCE RATINGS | | | | | | | |
|---|--------------|-------------------|---------|---------|------|--|--|
| Parameter | | Symbol | Typical | Maximum | Unit | | |
| Maximum Junction-to-Ambient ^{a, c} | t ≤ 10 s | R _{thJA} | 29 | 35 | °C/W | | |
| Maximum Junction-to-Foot | Steady State | $R_{th,IF}$ | 13 | 16 | C/VV | | |

Notes:

- a. Surface mounted on 1" x 1" FR4 board.
- b. t = 10 s.
- c. Maximum under steady state conditions is 80 °C/W.
- d. Based on $T_C = 25$ °C.



| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | | |
|--|-------------------------|--|------|--------|---------|---------|--|
| Parameter | Symbol | Test Conditions | Min. | Тур. | Max. | Unit | |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0 \text{ V, I}_{D} = -250 \mu\text{A}$ | - 30 | | | V | |
| V _{DS} Temperature Coefficient | $\Delta V_{DS}/T_{J}$ | I _D = - 250 μA | | - 31 | | mV/°C | |
| V _{GS(th)} Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | 5.3 | | mv/°C | |
| Gate-Source Threshold Voltage | V _{GS(th)} | $V_{DS} = V_{GS}, I_{D} = -250 \mu A$ | | | - 2.5 | V | |
| Gate-Source Leakage | I _{GSS} | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$ | | | ± 100 | nA | |
| | | V _{DS} = - 30 V, V _{GS} = 0 V | | | - 100 | | |
| Zero Gate Voltage Drain Current | l | V _{DS} = - 20 V, V _{GS} = 0 V | | | - 75 | μΑ | |
| Zero Gate voltage Drain Current | I _{DSS} | V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 75 °C | | | - 10 | | |
| | | V _{DS} = - 20 V, V _{GS} = 0 V, T _J = 75 °C | | | - 3 | | |
| On-State Drain Current ^a | I _{D(on)} | $V_{DS} \ge -10 \text{ V}, V_{GS} = -10 \text{ V}$ | - 30 | | | Α | |
| Dunin Course On Otata Basistan | R | V _{GS} = - 10 V, I _D = - 15 A | | 0.0039 | 0.005 | Ω | |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | V _{GS} = - 4.5 V, I _D = - 10 A | | 0.0062 | 0.00775 | | |
| Forward Transconductance ^a | 9 _{fs} | V _{DS} = - 10 V, I _D = - 15 A | | 24 | | S | |
| Dynamic ^b | | | | | | • | |
| Input Capacitance | C _{iss} | | | 6000 | | pF | |
| Output Capacitance | C _{oss} | $V_{DS} = -15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | | 860 | | | |
| Reverse Transfer Capacitance | C _{rss} | | | 790 | | | |
| Total Cata Chaves | | $V_{DS} = -15 \text{ V}, V_{GS} = -10 \text{ V}, I_{D} = -20 \text{ A}$ | | 129 | 195 | nC | |
| Total Gate Charge | Q_g | | | 61 | 95 | | |
| Gate-Source Charge | Q_{gs} | $V_{DS} = -15 \text{ V}, V_{GS} = -4.5 \text{ V}, I_{D} = -20 \text{ A}$ | | 16.5 | | | |
| Gate-Drain Charge | Q _{gd} | | | 23.5 | | | |
| Gate Resistance | R_{g} | f = 1 MHz | 0.6 | 3 | 6 | Ω | |
| Turn-On Delay Time | t _{d(on)} | | | 16 | 30 | | |
| Rise Time | t _r | $V_{DD} = -15 \text{ V}, R_{L} = 1.5 \Omega$ | | 16 | 30 | <u></u> | |
| Turn-Off DelayTime | t _{d(off)} | $I_D \cong$ - 10 A, $V_{GEN} =$ - 10 V, $R_g =$ 1 Ω | | 80 | 150 | | |
| Fall Time | t _f | | | 20 | 40 | 1 | |
| Turn-On Delay Time | t _{d(on)} | | | 75 | 150 | ns | |
| Rise Time | t _r | $V_{DD} = -15 \text{ V}, R_L = 1.5 \Omega$ | | 130 | 260 |] | |
| Turn-Off DelayTime | t _{d(off)} | $I_D \cong -10 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \Omega$ | | 60 | 120 | | |
| Fall Time | t _f | _ | | 40 | 80 | | |
| Drain-Source Body Diode Characteris | stics | | | | | • | |
| Continous Source-Drain Diode Current | I _S | T _C = 25 °C | | | - 29 | _ | |
| Pulse Diode Forward Current | I _{SM} | - | | | - 70 | A | |
| Body Diode Voltage | V _{SD} | I _S = - 3 A, V _{GS} = 0 V | | - 0.71 | - 1.2 | V | |
| Body Diode Reverse Recovery Time | t _{rr} | | | 67 | 130 | ns | |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | 74 | 150 | nC | |
| Reverse Recovery Fall Time | t _a | $I_F = -5 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$ | | 22 | | 1 | |
| Reverse Recovery Rise Time | t _b | | | 45 | | ns | |

Notes:

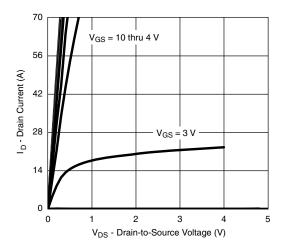
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

a. Pulse test; pulse width \leq 300 $\mu s,$ duty cycle \leq 2 %.

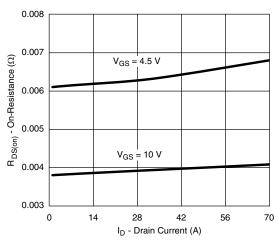
b. Guaranteed by design, not subject to production testing.



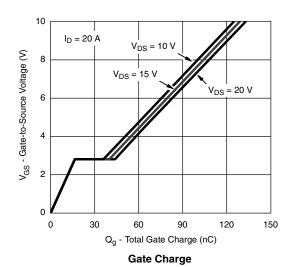
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

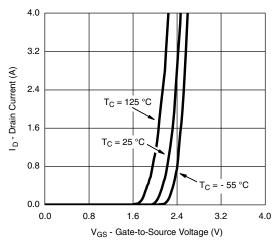


Output Characteristics

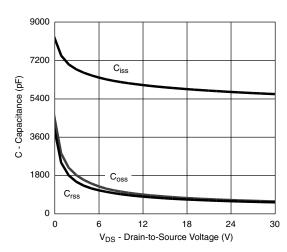


On-Resistance vs. Drain Current

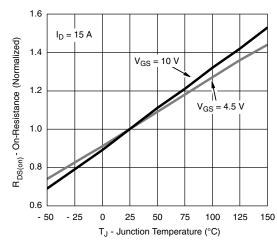




Transfer Characteristics

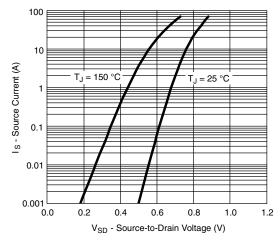


Capacitance

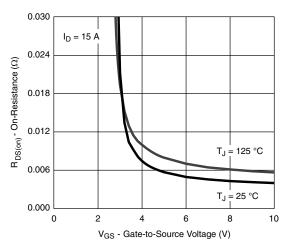


On-Resistance vs. Junction Temperature

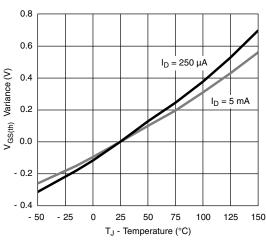
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



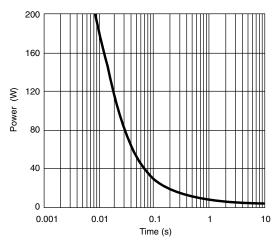
Source-Drain Diode Forward Voltage



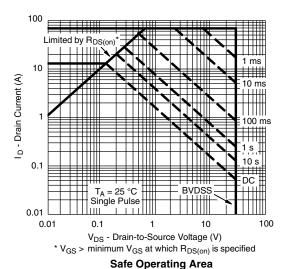
On-Resistance vs. Gate-to-Source Voltage



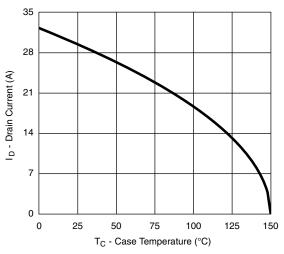
Threshold Voltage



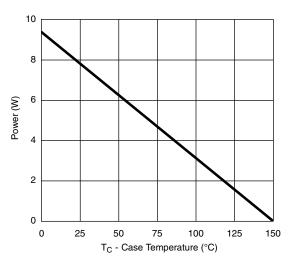
Single Pulse Power, Junction-to-Ambient



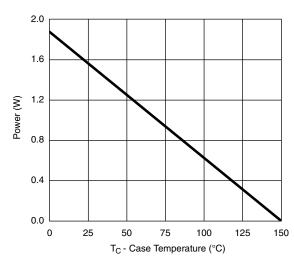
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating*





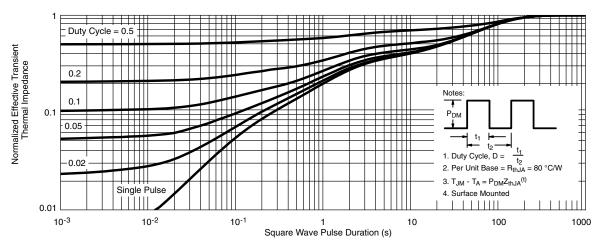


Power Derating, Junction-to-Ambient

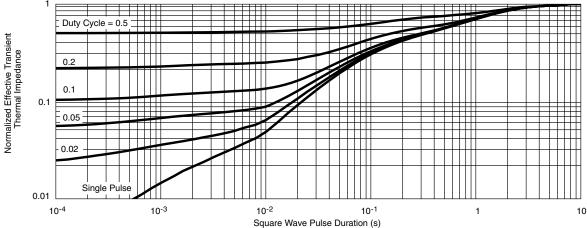
^{*} The power dissipation P_D is based on $T_{J(max)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package

VISHAY.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppq?69979.



SOIC (NARROW): 8-LEAD JEDEC Part Number: MS-012







| | MILLIM | MILLIMETERS INCHES | | | | |
|--------------------------------|--------|--------------------|-----------|-------|--|--|
| DIM | Min | Max | Min | Max | | |
| Α | 1.35 | 1.75 | 0.053 | 0.069 | | |
| A ₁ | 0.10 | 0.20 | 0.004 | 0.008 | | |
| В | 0.35 | 0.51 | 0.014 | 0.020 | | |
| С | 0.19 | 0.25 | 0.0075 | 0.010 | | |
| D | 4.80 | 5.00 | 0.189 | 0.196 | | |
| Е | 3.80 | 4.00 | 0.150 | 0.157 | | |
| е | 1.27 | BSC | 0.050 BSC | | | |
| Н | 5.80 | 6.20 | 0.228 | 0.244 | | |
| h | 0.25 | 0.50 | 0.010 | 0.020 | | |
| L | 0.50 | 0.93 | 0.020 | 0.037 | | |
| q | 0° | 8° | 0° | 8° | | |
| S | 0.44 | 0.64 | 0.018 | 0.026 | | |
| ECN: C-06527-Rev. I. 11-Sep-06 | | | | | | |

DWG: 5498

Document Number: 71192 www.vishay.com 11-Sep-06

Mounting LITTLE FOOT®, SO-8 Power MOSFETs

Wharton McDaniel

Surface-mounted LITTLE FOOT power MOSFETs use integrated circuit and small-signal packages which have been been modified to provide the heat transfer capabilities required by power devices. Leadframe materials and design, molding compounds, and die attach materials have been changed, while the footprint of the packages remains the same.

See Application Note 826, Recommended Minimum Pad Patterns With Outline Drawing Access for Vishay Siliconix MOSFETs, (http://www.vishay.com/ppg?72286), for the basis of the pad design for a LITTLE FOOT SO-8 power MOSFET. In converting this recommended minimum pad to the pad set for a power MOSFET, designers must make two connections: an electrical connection and a thermal connection, to draw heat away from the package.

In the case of the SO-8 package, the thermal connections are very simple. Pins 5, 6, 7, and 8 are the drain of the MOSFET for a single MOSFET package and are connected together. In a dual package, pins 5 and 6 are one drain, and pins 7 and 8 are the other drain. For a small-signal device or integrated circuit, typical connections would be made with traces that are 0.020 inches wide. Since the drain pins serve the additional function of providing the thermal connection to the package, this level of connection is inadequate. The total cross section of the copper may be adequate to carry the current required for the application, but it presents a large thermal impedance. Also, heat spreads in a circular fashion from the heat source. In this case the drain pins are the heat sources when looking at heat spread on the PC board.

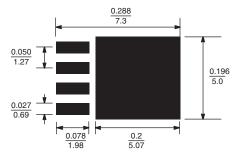


Figure 1. Single MOSFET SO-8 Pad Pattern With Copper Spreading

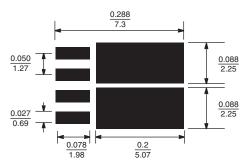


Figure 2. Dual MOSFET SO-8 Pad Pattern With Copper Spreading

The minimum recommended pad patterns for the single-MOSFET SO-8 with copper spreading (Figure 1) and dual-MOSFET SO-8 with copper spreading (Figure 2) show the starting point for utilizing the board area available for the heat-spreading copper. To create this pattern, a plane of copper overlies the drain pins. The copper plane connects the drain pins electrically, but more importantly provides planar copper to draw heat from the drain leads and start the process of spreading the heat so it can be dissipated into the ambient air. These patterns use all the available area underneath the body for this purpose.

Since surface-mounted packages are small, and reflow soldering is the most common way in which these are affixed to the PC board, "thermal" connections from the planar copper to the pads have not been used. Even if additional planar copper area is used, there should be no problems in the soldering process. The actual solder connections are defined by the solder mask openings. By combining the basic footprint with the copper plane on the drain pins, the solder mask generation occurs automatically.

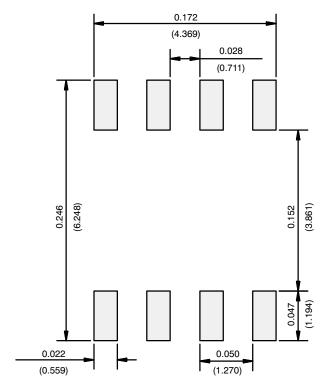
A final item to keep in mind is the width of the power traces. The absolute minimum power trace width must be determined by the amount of current it has to carry. For thermal reasons, this minimum width should be at least 0.020 inches. The use of wide traces connected to the drain plane provides a low impedance path for heat to move away from the device.

APPLICATION NOTE

Document Number: 70740 Revision: 18-Jun-07



RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads Dimensions in Inches/(mm)

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Revision: 02-Oct-12 Document Number: 91000

ПОСТАВКА ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

многоканальный

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Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru_6 moschip.ru_4 moschip.ru_9