

AP4405GEM-VB Datasheet

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

PRODUCT SUMMARY

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | I_D (A) ^d | Q_g (Typ.) |
|--------------|----------------------------|------------------------|--------------|
| - 30 | 0.011 at $V_{GS} = -10$ V | - 13.5 | 29.5 nC |
| | 0.015 at $V_{GS} = -4.5$ V | - 11.6 | |

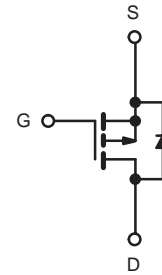
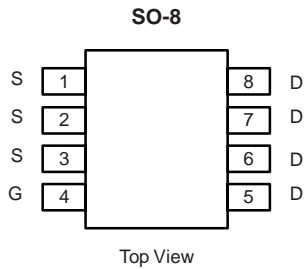
FEATURES

- Halogen-free
- Trench Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested


RoHS
 COMPLIANT

APPLICATIONS

- Load Switch
- Notebook Adaptor Switch



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$, unless otherwise noted

| Parameter | Symbol | Limit | Unit |
|--|----------------|--------------------------|------------------------|
| Drain-Source Voltage | V_{DS} | - 30 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current ($T_J = 150^\circ\text{C}$) | I_D | $T_C = 25^\circ\text{C}$ | - 13.5 |
| | | $T_C = 70^\circ\text{C}$ | - 11.9 |
| | | $T_A = 25^\circ\text{C}$ | - 10.9 ^{a, b} |
| | | $T_A = 70^\circ\text{C}$ | - 8.6 ^{a, b} |
| Pulsed Drain Current | I_{DM} | - 50 | A |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25^\circ\text{C}$ | - 4.1 |
| | | $T_A = 25^\circ\text{C}$ | - 2.2 ^{a, b} |
| Avalanche Current | I_{AS} | - 20 | |
| Single-Pulse Avalanche Energy | E_{AS} | 20 | mJ |
| Maximum Power Dissipation | P_D | $T_C = 25^\circ\text{C}$ | 5.0 |
| | | $T_C = 70^\circ\text{C}$ | 3.2 |
| | | $T_A = 25^\circ\text{C}$ | 2.7 ^{a, b} |
| | | $T_A = 70^\circ\text{C}$ | 1.7 ^{a, b} |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to 150 | $^\circ\text{C}$ |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Typical | Maximum | Unit |
|---|------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient ^{a, c} | R_{thJA} | 38 | 46 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Foot | R_{thJF} | 20 | 25 | |

Notes:

a. Surface mounted on 1" x 1" FR4 board.

 b. $t = 10$ s.

 c. Maximum under Steady State conditions is 85°C/W .

 d. Based on $T_C = 25^\circ\text{C}$.

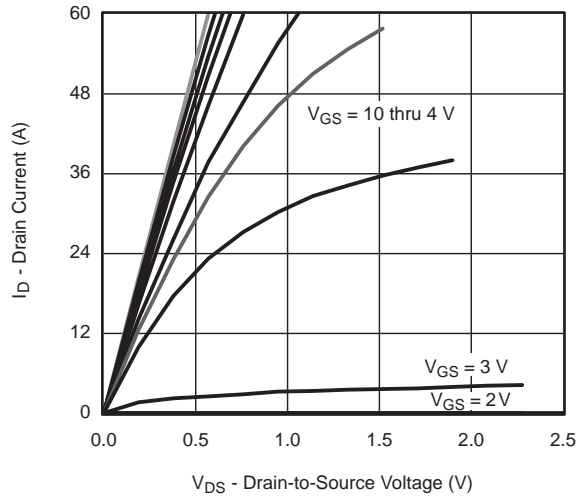
| SPECIFICATIONS T _J = 25 °C, unless otherwise noted | | | | | | | |
|---|--------------------------------------|---|-------|--------|-------|-----------|--|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit | |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = - 250 μA | - 30 | | | V | |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | I _D = - 250 μA | | - 34 | | mV/ °C | |
| V _{GS(th)} Temperature Coefficient | ΔV _{GS(th)} /T _J | | | 5.3 | | | |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = - 250 μA | - 1.4 | | - 2.5 | V | |
| Gate-Source Leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 25 V | | | ± 100 | nA | |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = - 30 V, V _{GS} = 0 V | | | - 1 | μA | |
| | | V _{DS} = - 30 V, V _{GS} = 0 V, T _J = 55 °C | | | - 5 | | |
| On-State Drain Current ^a | I _{D(on)} | V _{DS} ≥ - 10 V, V _{GS} = - 10 V | - 30 | | | A | |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | V _{GS} = - 10 V, I _D = - 10 A | | 0.011 | | Ω | |
| | | V _{GS} = - 4.5 V, I _D = - 8 A | | 0.015 | | | |
| Forward Transconductance ^a | g _{fs} | V _{DS} = - 10 V, I _D = - 10 A | | 28 | | S | |
| Dynamic ^b | | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} = - 15 V, V _{GS} = 0 V, f = 1 MHz | | 2550 | | pF | |
| Output Capacitance | C _{oss} | | | 455 | | | |
| Reverse Transfer Capacitance | C _{rss} | | | 390 | | | |
| Total Gate Charge | Q _g | V _{DS} = - 15 V, V _{GS} = - 10 V, I _D = - 10 A | | 57 | 86 | nC | |
| | | V _{DS} = - 15 V, V _{GS} = - 4.5 V, I _D = - 10 A | | 29.5 | 45 | | |
| | | | | | 8 | | |
| | | | | | 22 | | |
| Gate-Source Charge | Q _{gs} | | | | | | |
| Gate-Drain Charge | Q _{gd} | | | | | | |
| Gate Resistance | R _g | f = 1 MHz | 0.5 | 2.2 | 4.4 | Ω | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = - 15 V, R _L = 1.5 Ω I _D ≡ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω | | 13 | 25 | ns | |
| Rise Time | t _r | | | 12 | 24 | | |
| Turn-Off DelayTime | t _{d(off)} | | | 40 | 70 | | |
| Fall Time | t _f | | | 9 | 18 | | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = - 15 V, R _L = 1.5 Ω I _D ≡ - 10 A, V _{GEN} = - 4.5 V, R _g = 1 Ω | | 48 | 80 | | |
| Rise Time | t _r | | | 92 | 160 | | |
| Turn-Off DelayTime | t _{d(off)} | | | 34 | 60 | | |
| Fall Time | t _f | | | 19 | 35 | | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continous Source-Drain Diode Current | I _S | T _C = 25 °C | | | - 4.1 | A | |
| Pulse Diode Forward Current | I _{SM} | | | | - 60 | | |
| Body Diode Voltage | V _{SD} | I _S = - 3 A, V _{GS} = 0 V | | - 0.75 | - 1.2 | V | |
| Body Diode Reverse Recovery Time | t _{rr} | I _F = - 10 A, dI/dt = 100 A/μs, T _J = 25 °C | | 27 | 45 | ns | |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | 16 | 27 | nC | |
| Reverse Recovery Fall Time | t _a | | | 12 | | ns | |
| Reverse Recovery Rise Time | t _b | | | 15 | | | |

Notes:

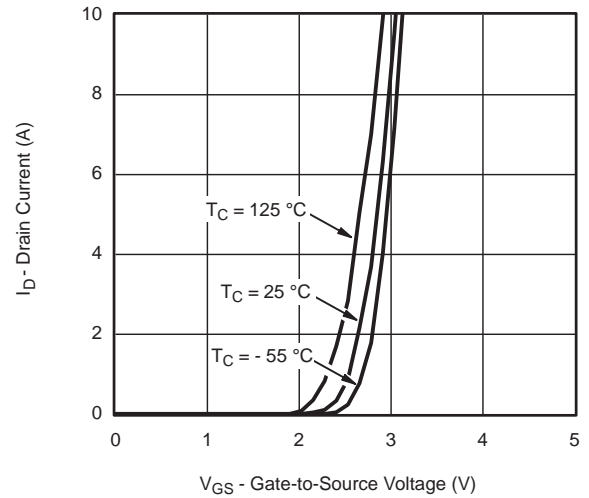
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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

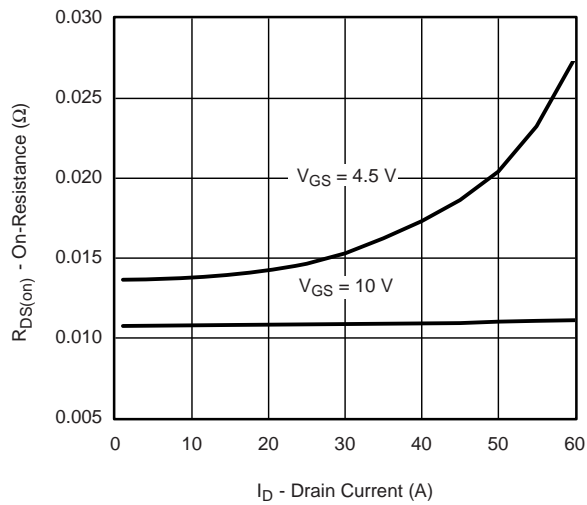
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted


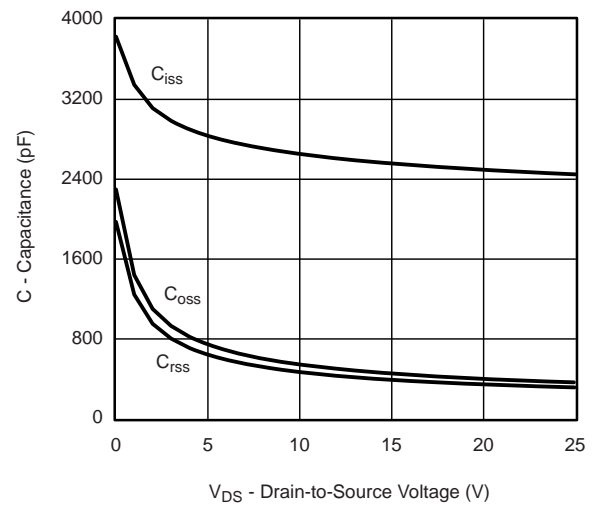
Output Characteristics



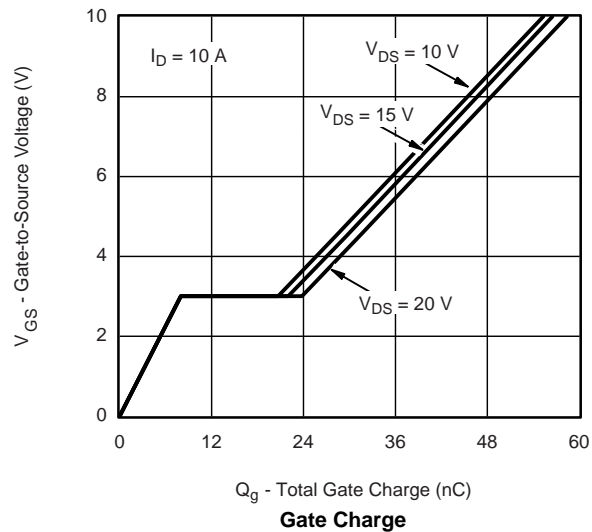
Transfer Characteristics



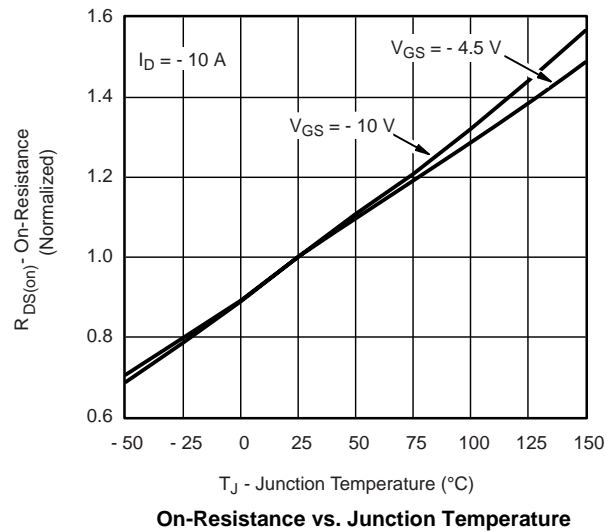
On-Resistance vs. Drain Current



Capacitance

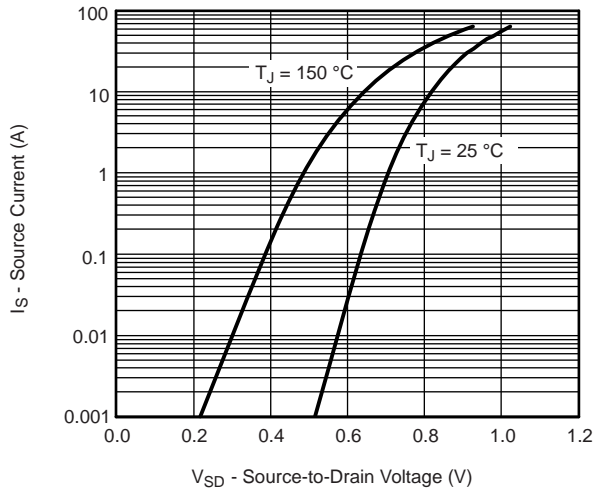


Gate Charge

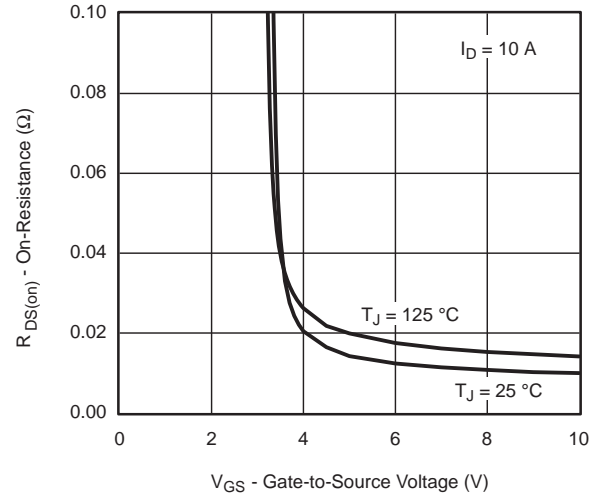


On-Resistance vs. Junction Temperature

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



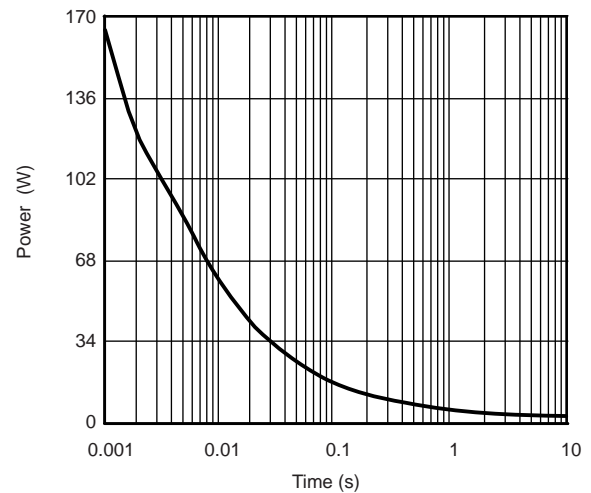
Source-Drain Diode Forward Voltage



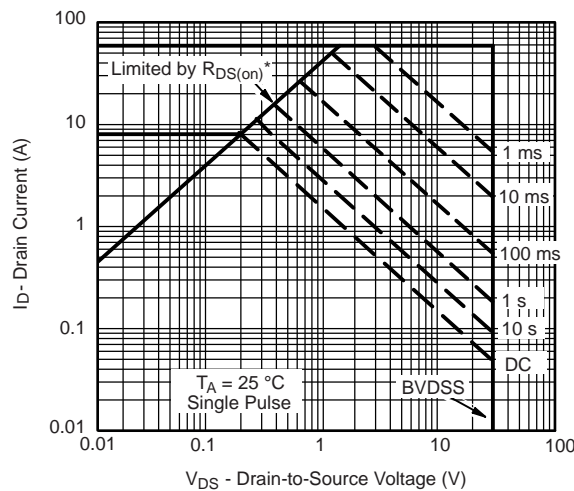
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

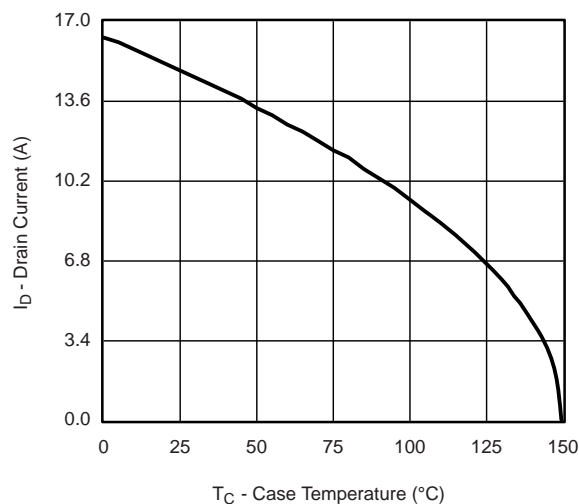
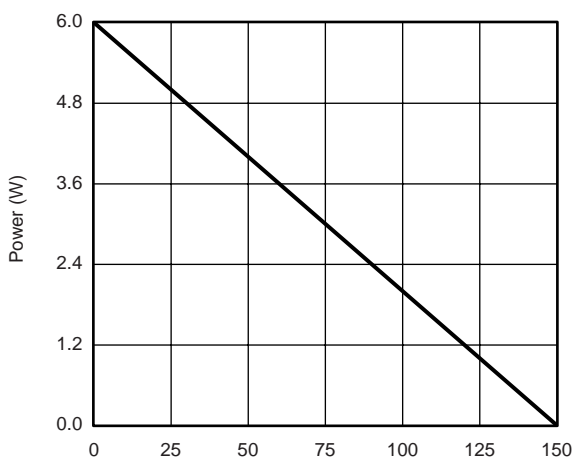
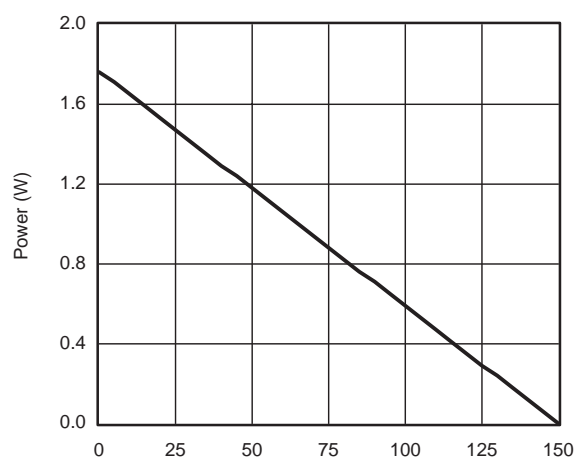


Single Pulse Power, Junction-to-Ambient

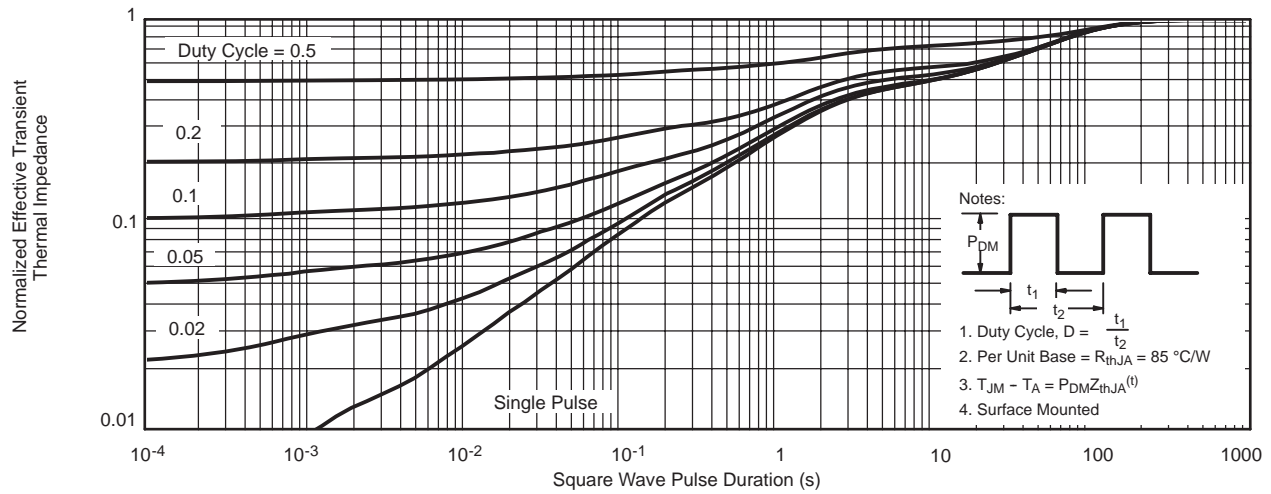
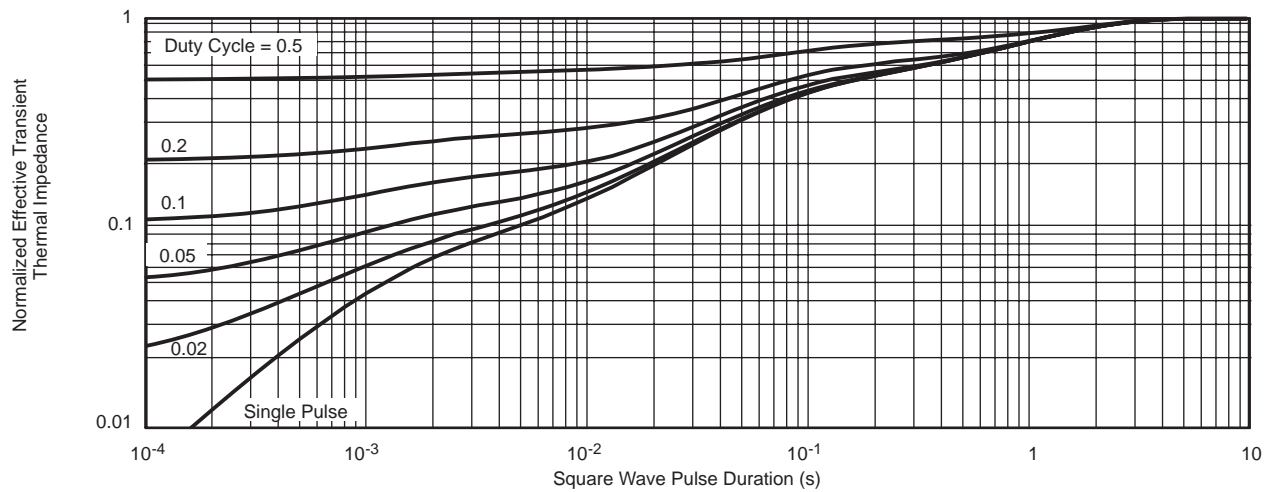


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

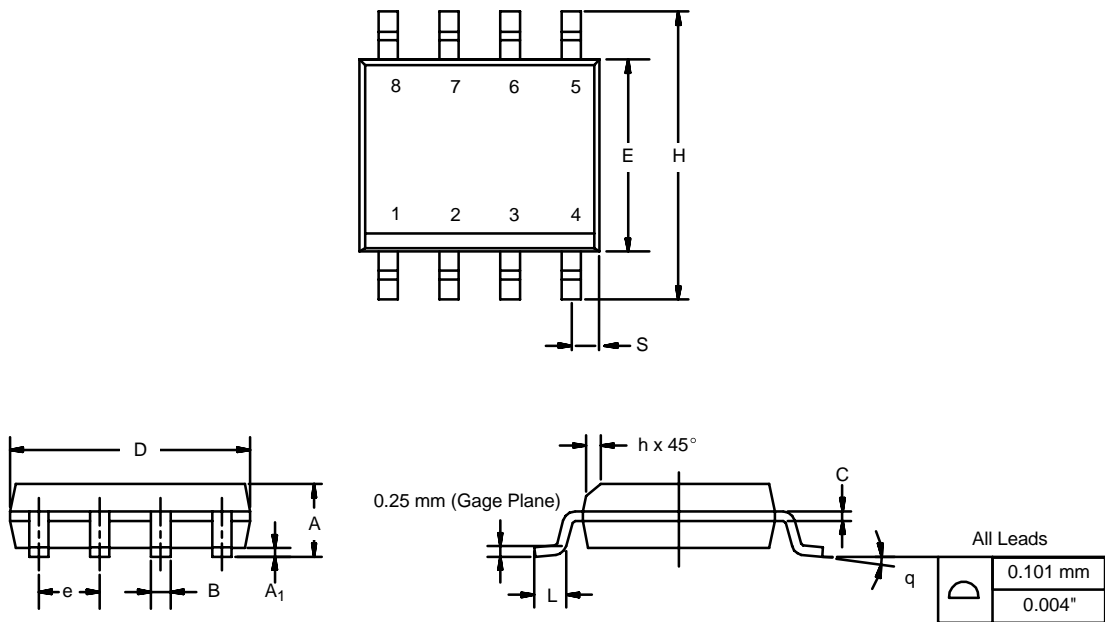
MOSFET TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Current Derating*

Power, Junction-to-Foot

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 limit.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

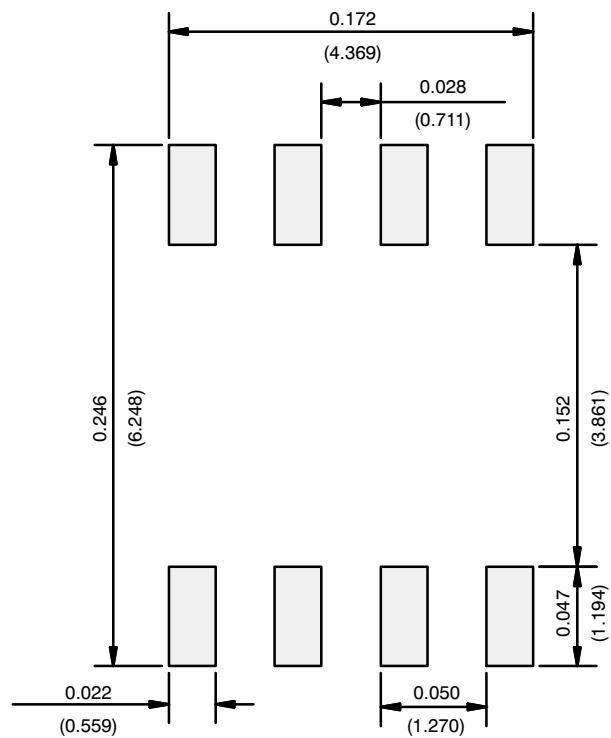
SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



| DIM | MILLIMETERS | | INCHES | |
|--------------------------------|-------------|------|-----------|-------|
| | Min | Max | Min | Max |
| A | 1.35 | 1.75 | 0.053 | 0.069 |
| A ₁ | 0.10 | 0.20 | 0.004 | 0.008 |
| B | 0.35 | 0.51 | 0.014 | 0.020 |
| C | 0.19 | 0.25 | 0.0075 | 0.010 |
| D | 4.80 | 5.00 | 0.189 | 0.196 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 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 | | | | |

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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