

N and P-Channel Enhancement Mode Power MOSFET

Description

The HM4611A uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. It can be used in a wide variety of applications.

General Features

● N-Channel

$V_{DS} = 60V, I_D = 9.0A$

$R_{DS(ON)} < 16m\Omega @ V_{GS}=10V$ (Typ:12m Ω)

$R_{DS(ON)} < 24m\Omega @ V_{GS}=4.5V$ (Typ:18m Ω)

● P-Channel

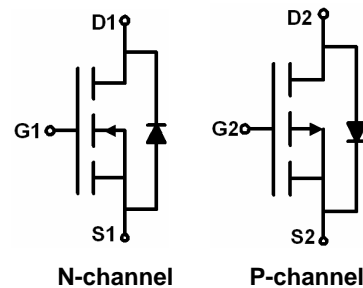
$V_{DS} = -60V, I_D = -6.5A$

$R_{DS(ON)} < 45m\Omega @ V_{GS}=-10V$

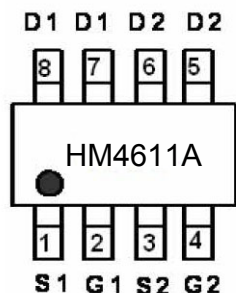
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- 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.

Application

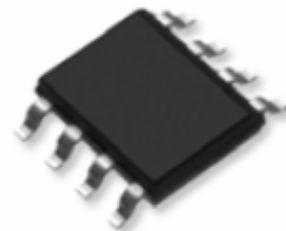
- Power switching application
- 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.
- DC-DC Converter



Schematic diagram



Marking and pin assignment



SOP-8 top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|------------|
| HM4611A | HM4611A | SOP-8 | Ø330mm | 12mm | 2500 units |

Absolute Maximum Ratings ($T_A=25^{\circ}C$ unless otherwise noted)

| Parameter | Symbol | N-Channel | P-Channel | Unit |
|--|----------------|------------|------------|-------------|
| Drain-Source Voltage | V_{DS} | 60 | -55 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | ± 20 | V |
| Continuous Drain Current | I_D | 9 | -6.5 | A |
| Pulsed Drain Current (Note 1) | I_{DM} | 36 | -32 | A |
| Maximum Power Dissipation | P_D | 3.1 | 3 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | -55 To 150 | $^{\circ}C$ |

Thermal Characteristic

| | | | | |
|---|-----------------|------|------|----------------------|
| Thermal Resistance, Junction-to-Ambient (Note2) | $R_{\theta JA}$ | N-Ch | 62.5 | $^{\circ}\text{C/W}$ |
| | | P-Ch | 42 | |

N-CH Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|------------------------------------|---------------------|--|-----|------|------|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V I _D =250μA | 60 | 69 | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =60V, V _{GS} =0V | - | - | 1 | μA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±20V, V _{DS} =0V | - | - | ±100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =250μA | 2 | 3 | 4 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _D =9A | | 12 | 16 | |
| | | V _{GS} =4.5V, I _D =6A | - | 18 | 24 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =4.5A | 11 | - | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =25V, V _{GS} =0V,
F=1.0MHz | | 450 | | PF |
| Output Capacitance | C _{oss} | | | 60 | | PF |
| Reverse Transfer Capacitance | C _{rss} | | | 25 | | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DS} =30V, I _D =4.5A
V _{GS} =10V, R _{GEN} =3Ω | - | 4.7 | - | nS |
| Turn-on Rise Time | t _r | | - | 2.3 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 15.7 | - | nS |
| Turn-Off Fall Time | t _f | | - | 1.9 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =30V, I _D =4.5A,
V _{GS} =10V | - | 8.5 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 1.6 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 2.2 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V _{SD} | V _{GS} =0V, I _S =3.7A | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | I _S | | - | - | 4 | A |

*...

P-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|------------------------------------|---------------------|--|------|------|------|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V I _D =-250μA | -55 | - | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =-55V, V _{GS} =0V | - | - | 1 | μA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±20V, V _{DS} =0V | - | - | ±100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =-250μA | -2.0 | -2.9 | -3.5 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =-10V, I _D =-6.5A | - | 39 | 45 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =-15V, I _D =-6.5A | 16 | - | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C _{ISS} | V _{DS} =-20V, V _{GS} =0V,
F=1.0MHz | - | 1450 | - | PF |
| Output Capacitance | C _{OSS} | | - | 145 | - | PF |
| Reverse Transfer Capacitance | C _{RSS} | | - | 110 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =-30V, ,R _L =30Ω
V _{GS} =-10V, R _{GEN} =6Ω | - | 8 | - | nS |
| Turn-on Rise Time | t _r | | - | 9 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 65 | - | nS |
| Turn-Off Fall Time | t _f | | - | 30 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =-30V, I _D =-6.5A,
V _{GS} =-10V | - | 26 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 4.5 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 7 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V _{SD} | V _{GS} =0V, I _S =-3A | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | I _S | | - | - | -6.5 | A |

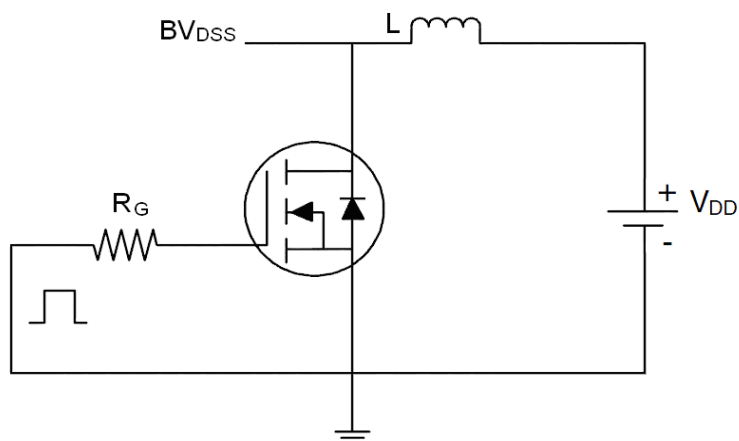
Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

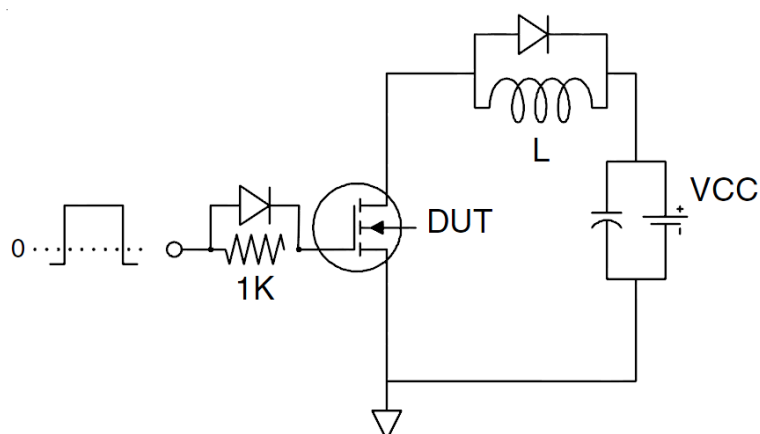
N- Channel Typical Electrical and Thermal Characteristics (Curves)

Test circuit

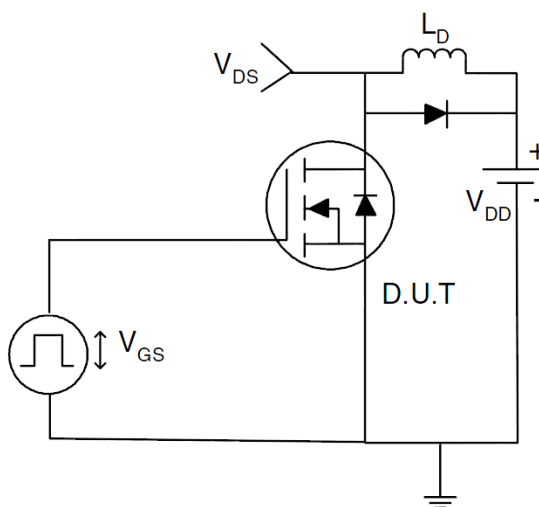
1) E_{AS} test Circuits



2) Gate charge test Circuit:



3) Switch Time Test Circuit:



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (Curves)

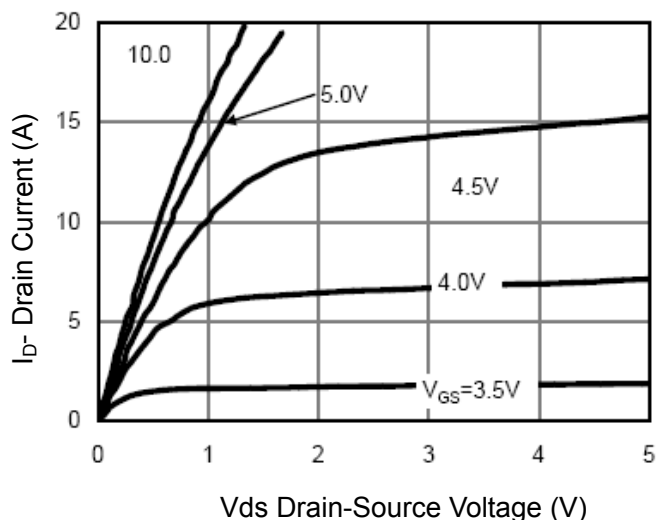


Figure 1 Output Characteristics

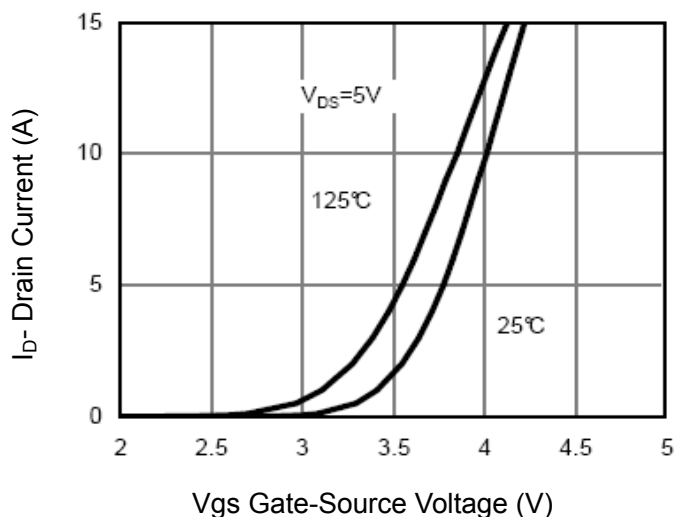


Figure 2 Transfer Characteristics

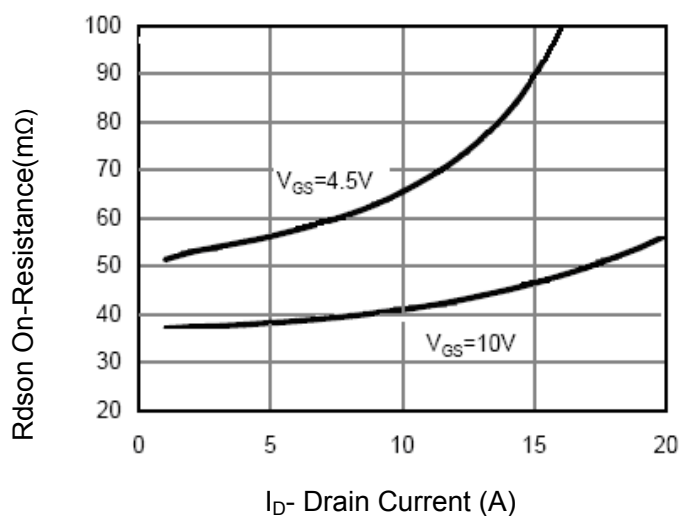


Figure 3 Rdson- Drain Current

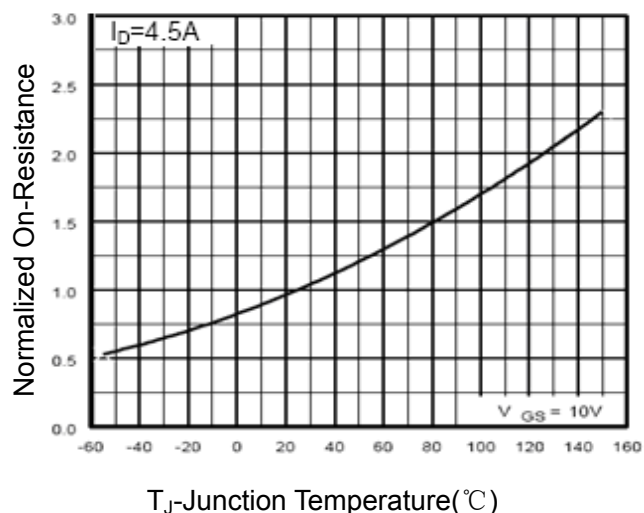


Figure 4 Rdson-Junction Temperature

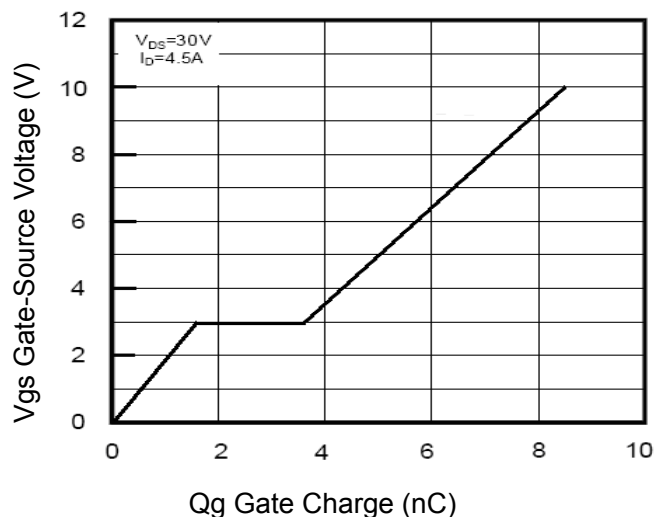


Figure 5 Gate Charge

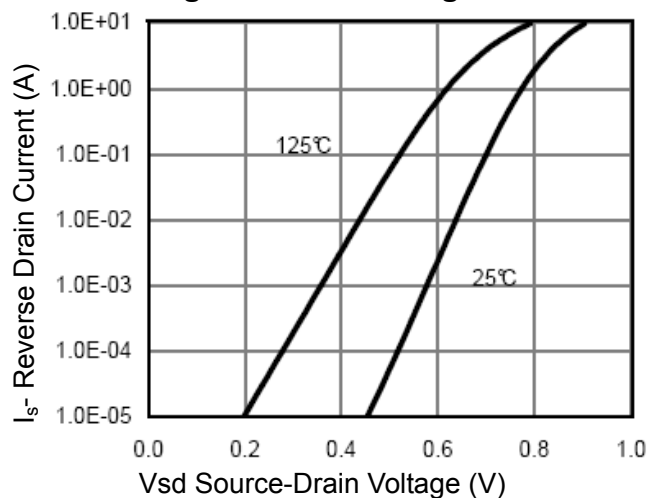


Figure 6 Source- Drain Diode Forward

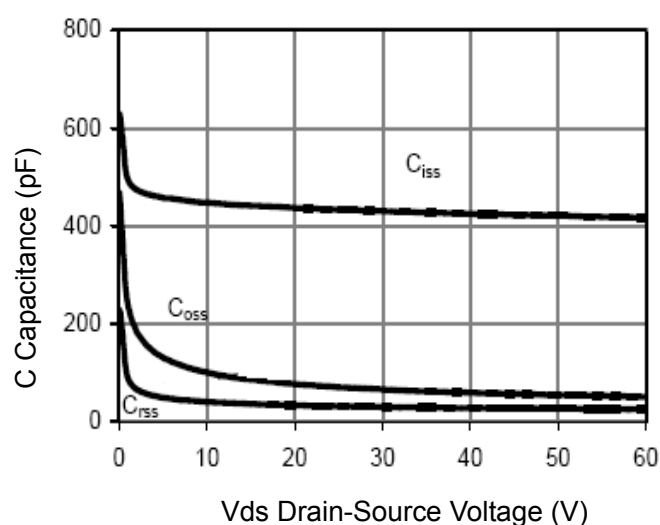


Figure 7 Capacitance vs Vds

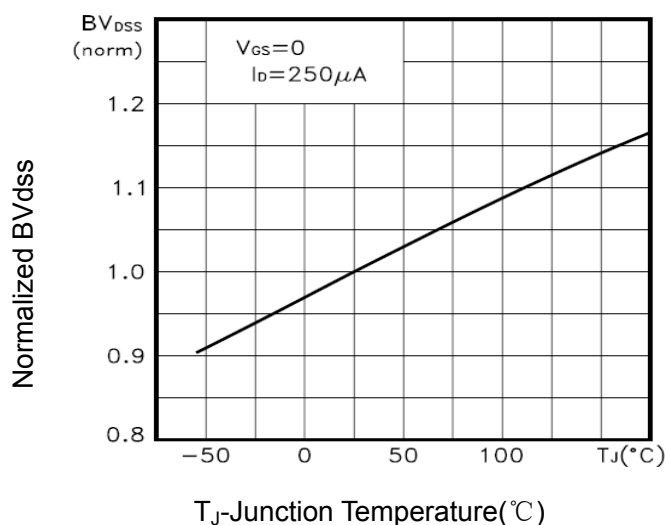


Figure 9 BV_{DSS} vs Junction Temperature

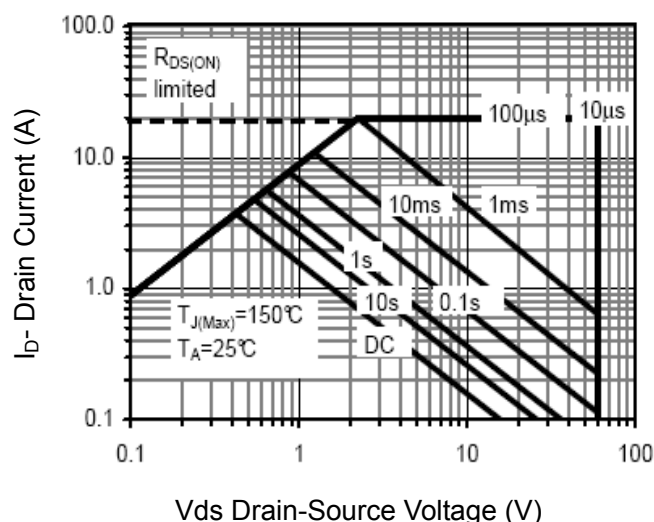


Figure 8 Safe Operation Area

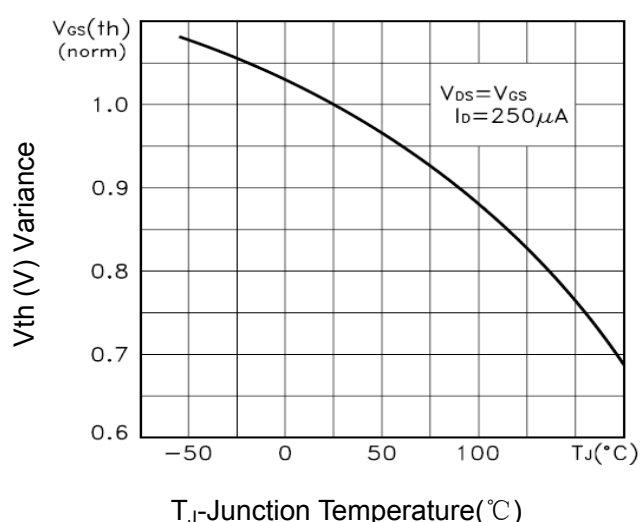


Figure 10 $V_{GS(th)}$ vs Junction Temperature

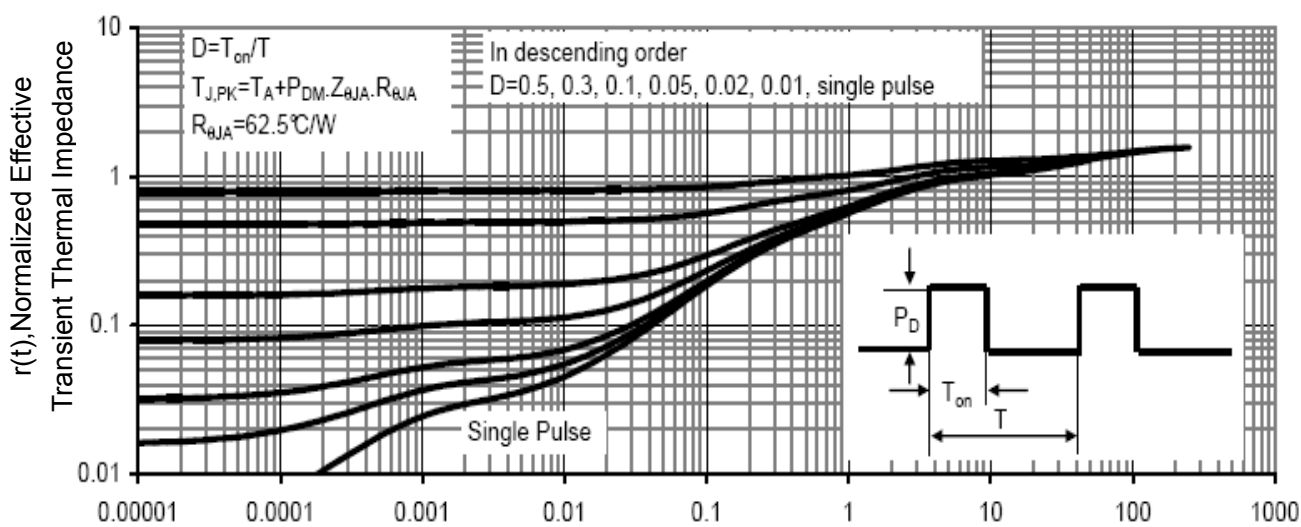
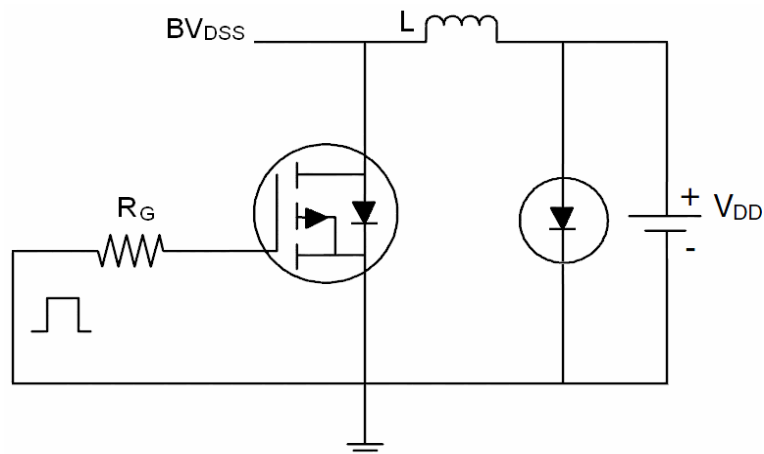


Figure 11 Normalized Maximum Transient Thermal Impedance

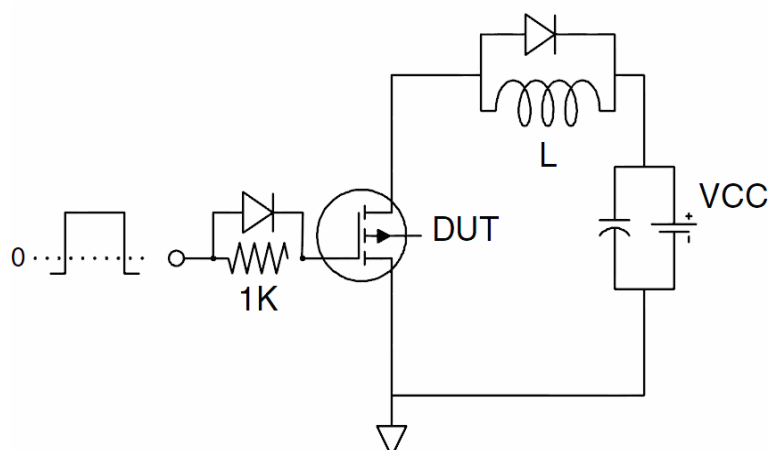
P-Channel Typical Electrical and Thermal Characteristics

Test Circuit

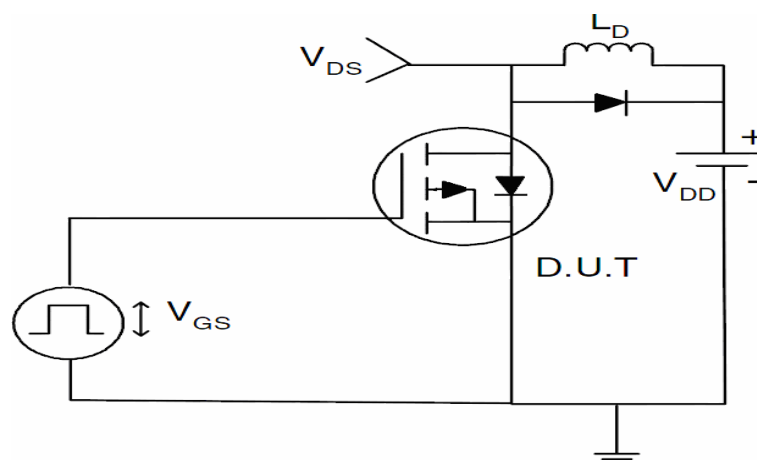
1) E_{AS} Test Circuit



2) Gate Charge Test Circuit



3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

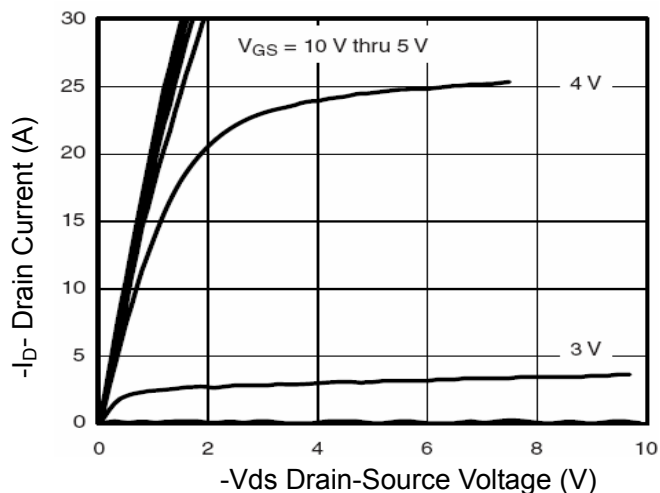


Figure 1 Output Characteristics

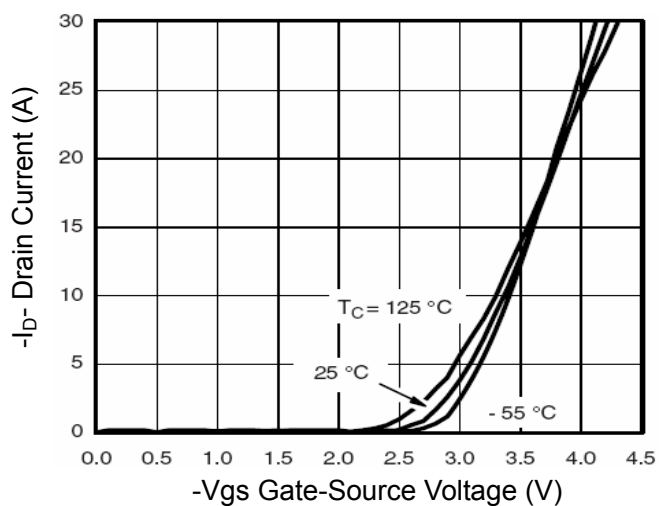


Figure 2 Transfer Characteristics

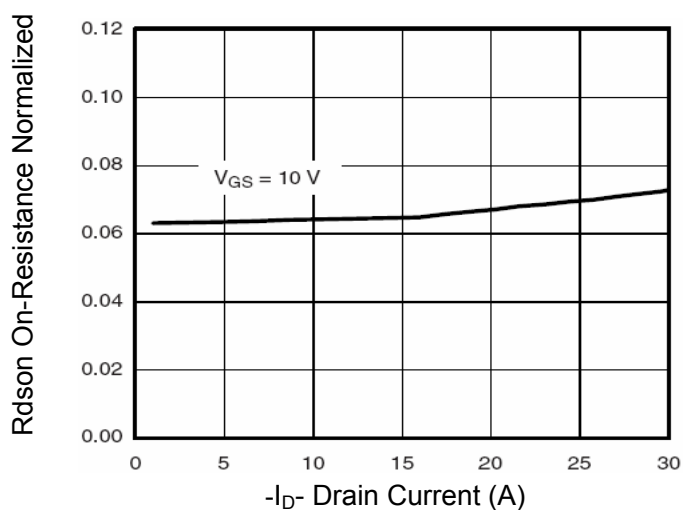


Figure 3 Rdson- Drain Current

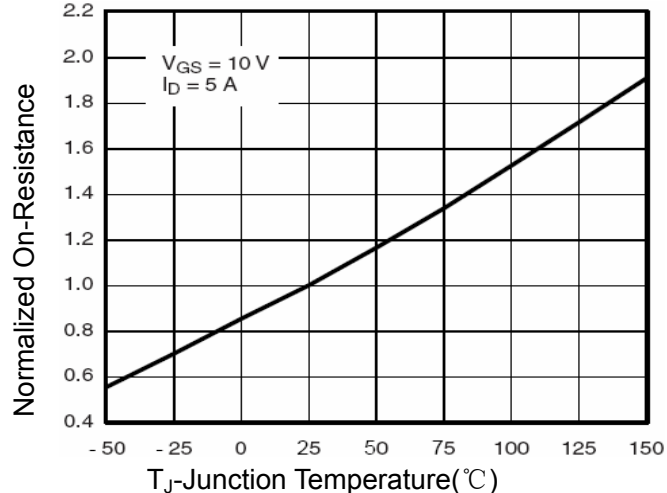


Figure 4 Rdson-Junction Temperature

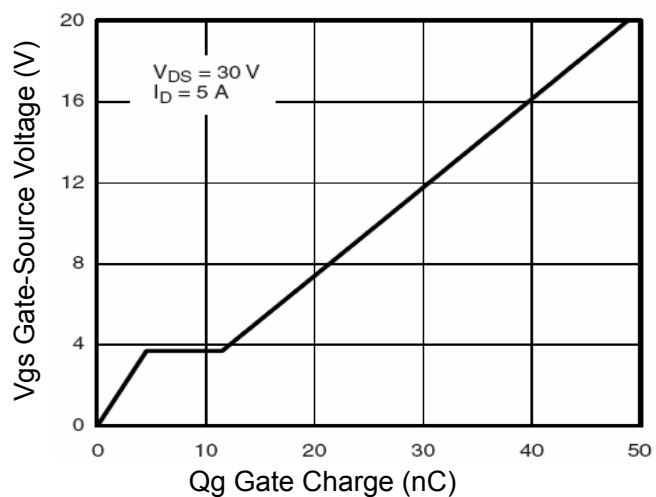


Figure 5 Gate Charge

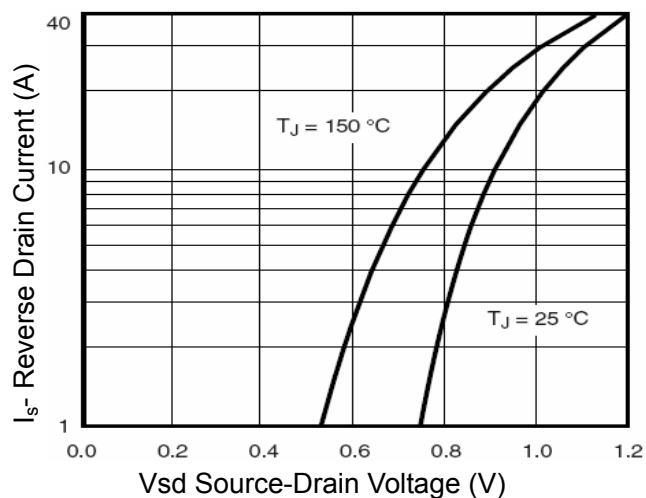


Figure 6 Source- Drain Diode Forward

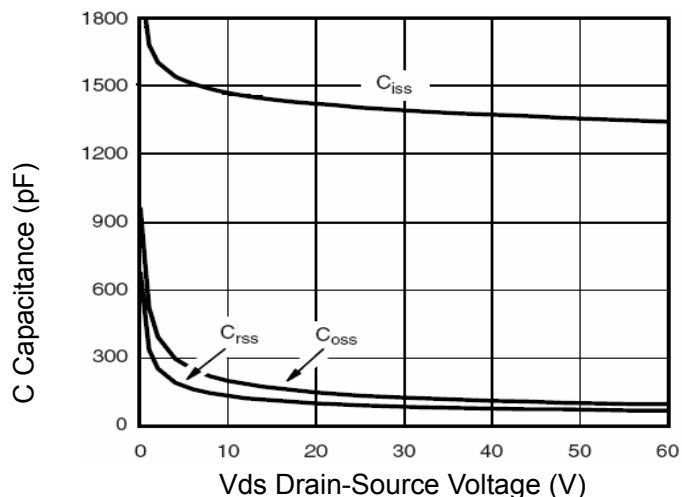


Figure 7 Capacitance vs Vds

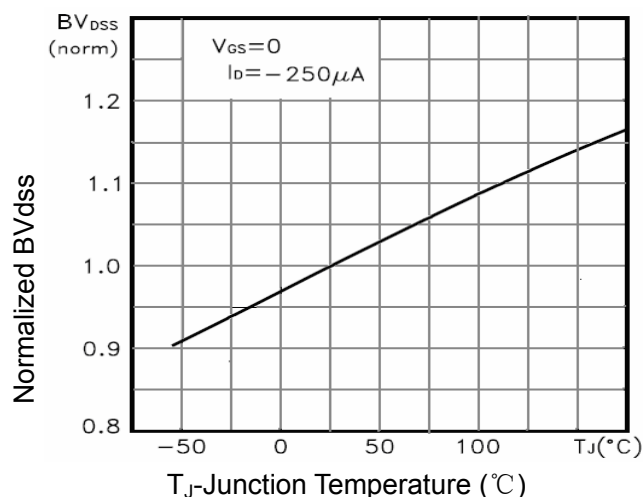


Figure 9 BV_{DSS} vs Junction Temperature

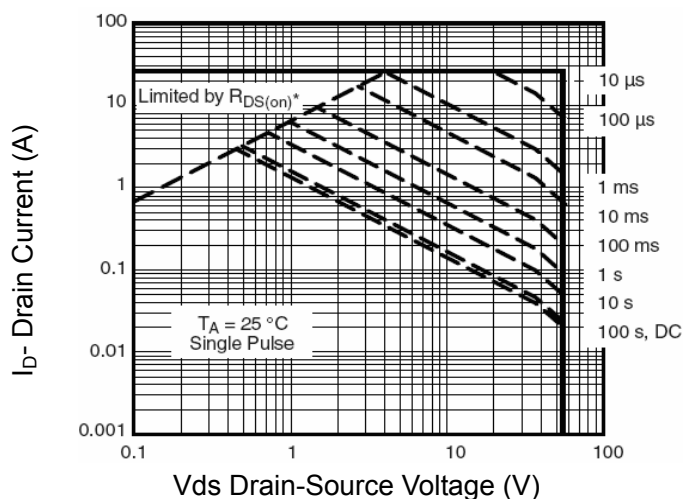


Figure 8 Safe Operation Area

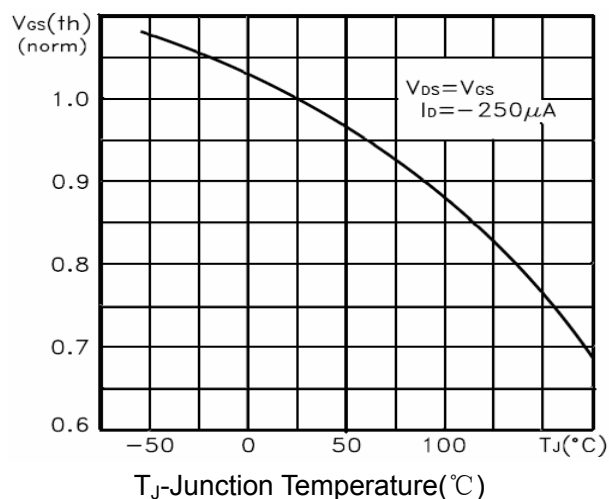


Figure 10 V_{GS(th)} vs Junction Temperature

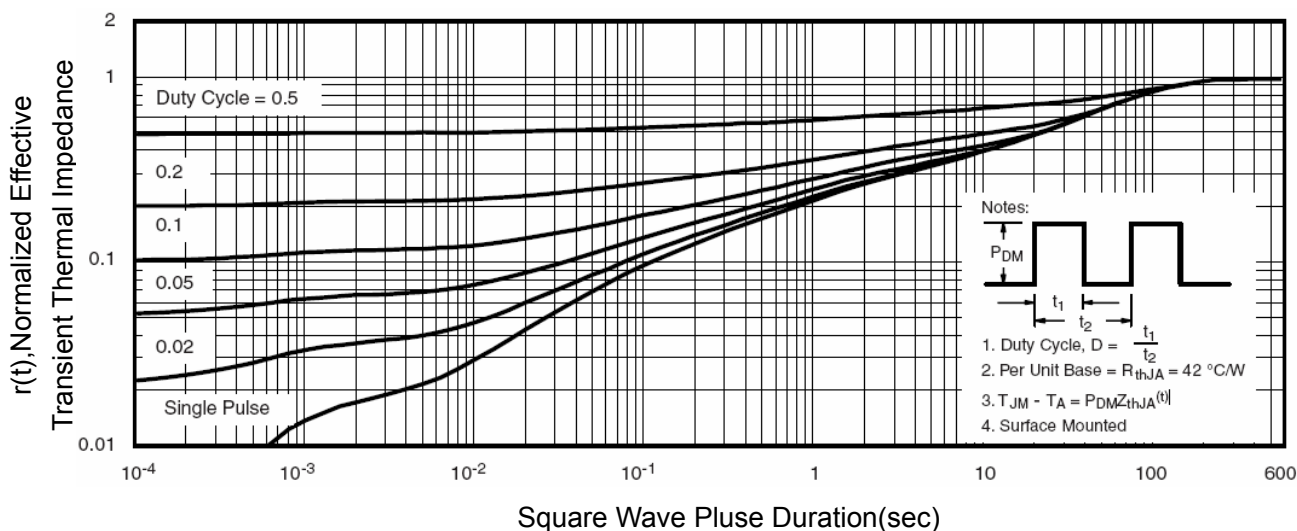
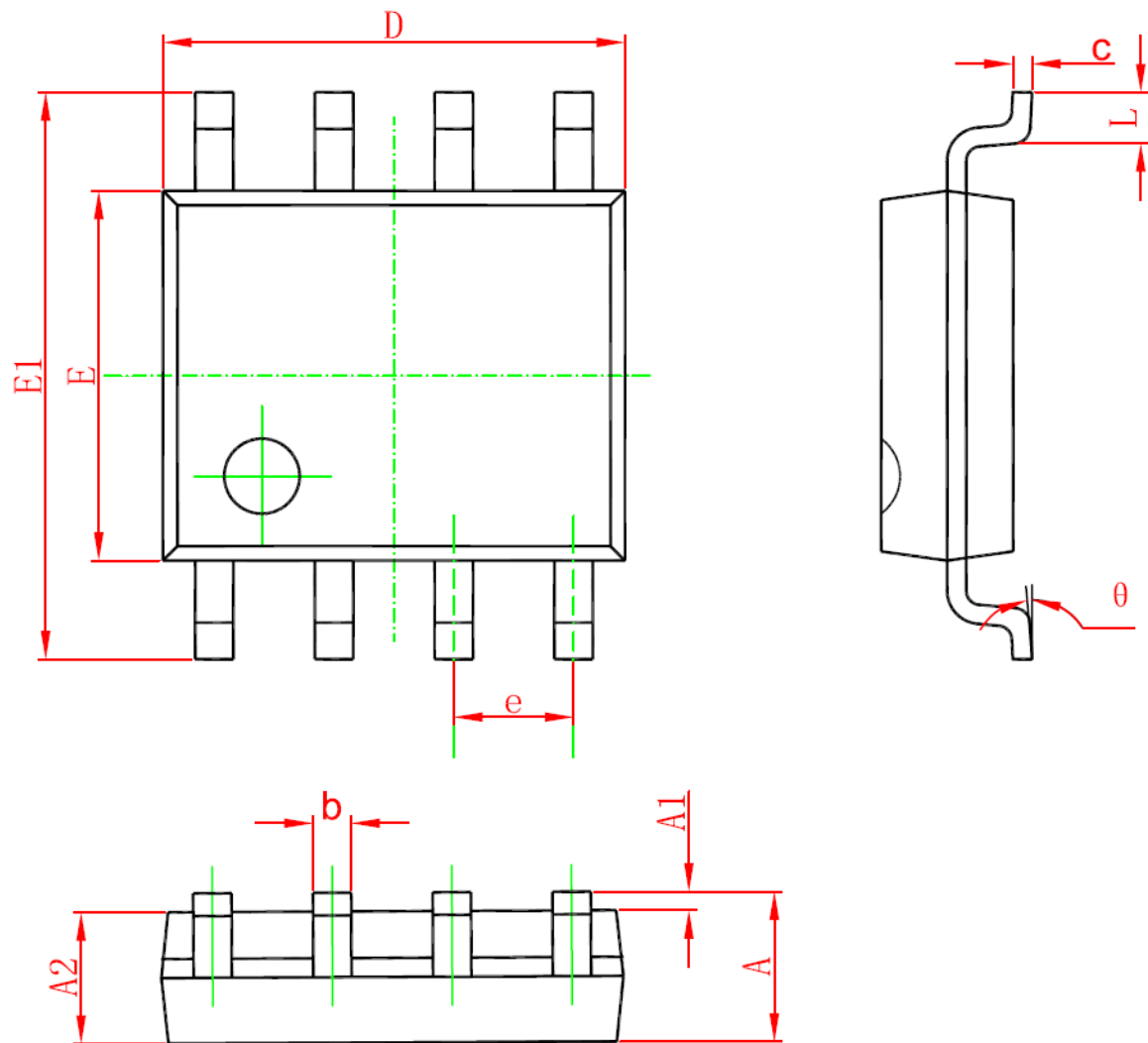


Figure 11 Normalized Maximum Transient Thermal Impedance

SOP-8 Package Information



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270 (BSC) | | 0.050 (BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

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