

NTMFS4120N

Power MOSFET

30 V, 31 A, Single N-Channel,
SO-8 Flat Lead

Features

- Low $R_{DS(on)}$
- Optimized Gate Charge
- Low Inductance SO-8 Package
- These are Pb-Free Devices

Applications

- Notebooks, Graphics Cards
- DC-DC Converters
- Synchronous Rectification

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | | Symbol | Value | Unit |
|---|-------------------------------|----------------|--------------------------|------------------|
| Drain-to-Source Voltage | | V_{DS} | 30 | V |
| Gate-to-Source Voltage | | V_{GS} | ± 20 | V |
| Continuous Drain Current (Note 1) | Steady State | I_D | $T_A = 25^\circ\text{C}$ | A |
| | | | $T_A = 85^\circ\text{C}$ | |
| | $t \leq 10\text{ s}$ | | $T_A = 25^\circ\text{C}$ | |
| Power Dissipation (Note 1) | Steady State | P_D | $T_A = 25^\circ\text{C}$ | W |
| | $t \leq 10\text{ s}$ | | | |
| Continuous Drain Current (Note 2) | Steady State | I_D | $T_A = 25^\circ\text{C}$ | A |
| | | | $T_A = 85^\circ\text{C}$ | |
| Power Dissipation (Note 2) | | P_D | $T_A = 25^\circ\text{C}$ | W |
| Pulsed Drain Current | $t_p = 10\text{ }\mu\text{s}$ | I_{DM} | 94 | A |
| Operating Junction and Storage Temperature | | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | | I_S | 7.0 | A |
| Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_{PK} = 30\text{ A}$, $L = 1\text{ mH}$, $R_G = 25\text{ }\Omega$) | | E_{AS} | 450 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T_L | 260 | $^\circ\text{C}$ |

THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|--------------------|
| Junction-to-Case - Steady State | $R_{\theta JC}$ | 1.7 | $^\circ\text{C/W}$ |
| Junction-to-Ambient - Steady State (Note 1) | $R_{\theta JA}$ | 55.8 | |
| Junction-to-Ambient - $t \leq 10\text{ s}$ (Note 1) | $R_{\theta JA}$ | 18 | |
| Junction-to-Ambient - Steady State (Note 2) | $R_{\theta JA}$ | 139.1 | |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

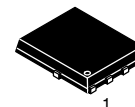
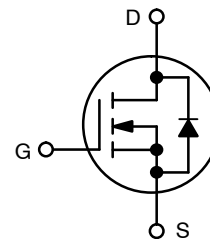
1. Surface mounted on FR4 board using 1 in sq pad size
(Cu area = 1.127 in sq [1 oz] including traces).
2. Surface mounted on FR4 board using the minimum recommended pad size
(Cu area = 1.0 in sq).



ON Semiconductor®

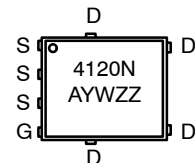
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ | I_D Max (Note 1) |
|---------------|------------------------|-----------------------|
| 30 V | 3.5 m Ω @ 10 V | 31 A |
| | 4.2 m Ω @ 4.5 V | |



SO-8 FLAT LEAD
CASE 488AA
STYLE 1

MARKING DIAGRAM



4120N = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|----------------------|------------------|
| NTMFS4120NT1G | SO-8 FL (Pb-Free) | 1500 Tape & Reel |
| NTMFS4120NT3G | SO-8 FL (Pb-Free) | 5000 Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

NTMFS4120N

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

| Characteristic | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|--------------------------------------|--|------------------------|-----|-----|-------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} = 0 V, I _D = 250 μA | 30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | | | 21 | | mV/°C |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{GS} = 0 V, V _{DS} = 24 V | T _J = 25°C | | 1.0 | μA |
| | | | T _J = 125°C | | 10 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{DS} = 0 V, V _{GS} = 20 V | | | 100 | nA |

ON CHARACTERISTICS (Note 3)

| | | | | | | |
|--|-------------------------------------|---|-----|-----|-----|-------|
| Gate Threshold Voltage | V _{GS(TH)} | V _{GS} = V _{DS} , I _D = 250 μA | 1.0 | | 2.5 | V |
| Negative Threshold Temperature Coefficient | V _{GS(TH)} /T _J | | | 7.4 | | mV/°C |
| Drain-to-Source On Resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 26 A | | 3.5 | 4.5 | mΩ |
| | | V _{GS} = 4.5 V, I _D = 24 A | | 4.2 | 5.5 | |
| Forward Transconductance | g _{FS} | V _{DS} = 15 V, I _D = 26 A | | 35 | | S |

CHARGES, CAPACITANCES AND GATE RESISTANCE

| | | | | | | |
|------------------------------|---------------------|--|--|------|----|----|
| Input Capacitance | C _{ISS} | V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 24 V | | 3600 | | pF |
| Output Capacitance | C _{OSS} | | | 640 | | |
| Reverse Transfer Capacitance | C _{RSS} | | | 380 | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 4.5 V, V _{DS} = 15 V, I _D = 24 A | | 33 | 50 | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | 4.4 | | |
| Gate-to-Source Charge | Q _{GS} | | | 13 | | |
| Gate-to-Drain Charge | Q _{GD} | | | 14 | | |
| Gate Resistance | R _G | | | 1.0 | | Ω |

SWITCHING CHARACTERISTICS (Note 4)

| | | | | | | |
|---------------------|---------------------|--|--|----|--|----|
| Turn-On Delay Time | t _{d(ON)} | V _{GS} = 4.5 V, V _{DS} = 15 V, I _D = 1.0 A, R _G = 3.0 Ω | | 24 | | ns |
| Rise Time | t _r | | | 32 | | |
| Turn-Off Delay Time | t _{d(OFF)} | | | 27 | | |
| Fall Time | t _f | | | 31 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|--|------------------------|----|------|-----|---|
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 6.0 A | T _J = 25°C | | 0.74 | 1.0 | V |
| | | | T _J = 125°C | | 0.6 | | |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 6.0 A | | 36 | | ns | |
| Charge Time | t _a | | | 18 | | | |
| Discharge Time | t _b | | | 18 | | | |
| Reverse Recovery Charge | Q _{RR} | | | 34 | | nC | |

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

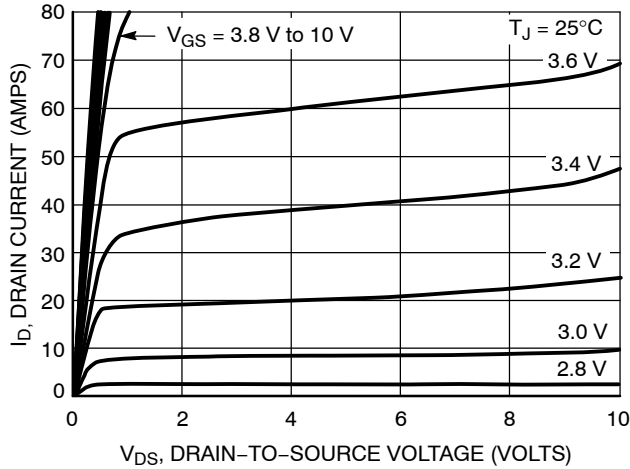


Figure 1. On-Region Characteristics

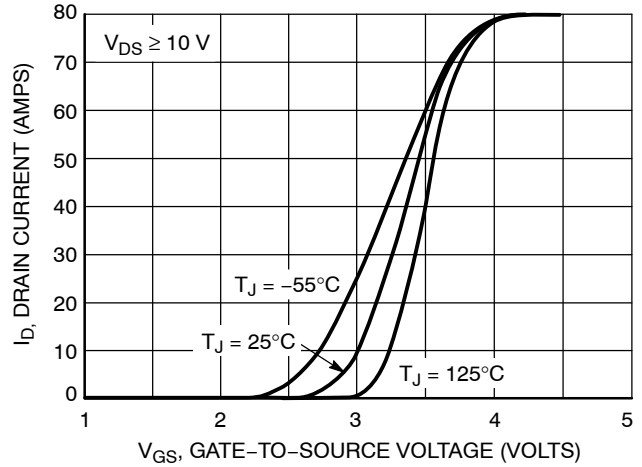


Figure 2. Transfer Characteristics

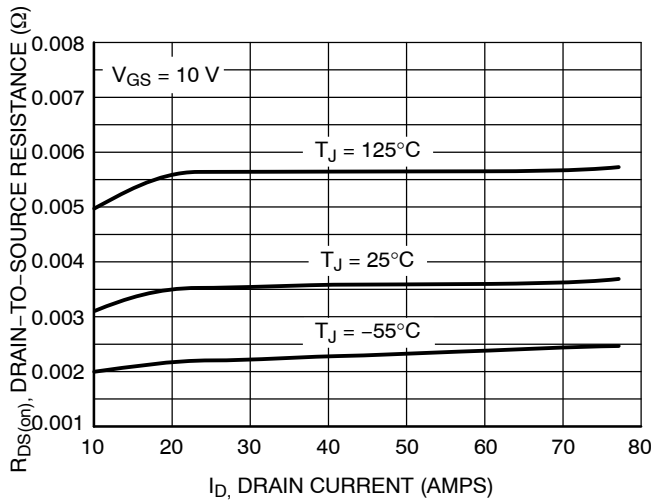


Figure 3. On-Resistance vs. Drain Current and Temperature

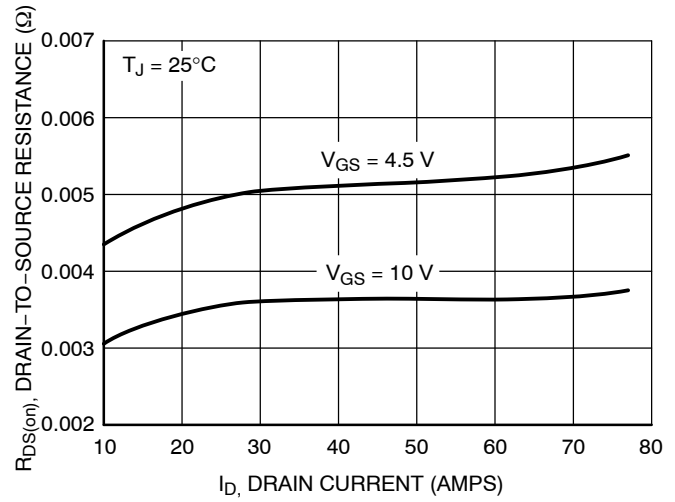


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

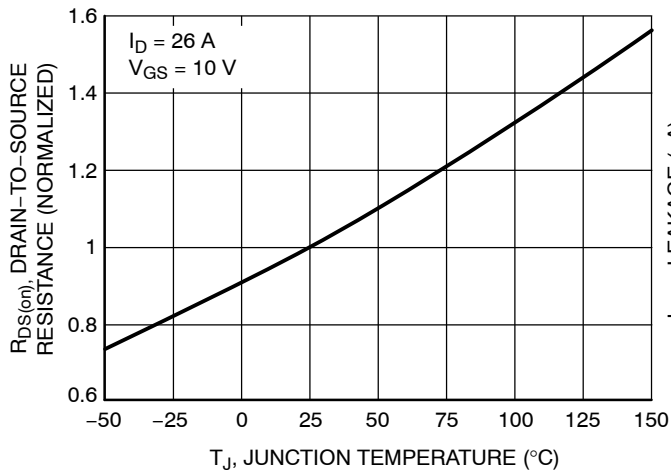


Figure 5. On-Resistance Variation with Temperature

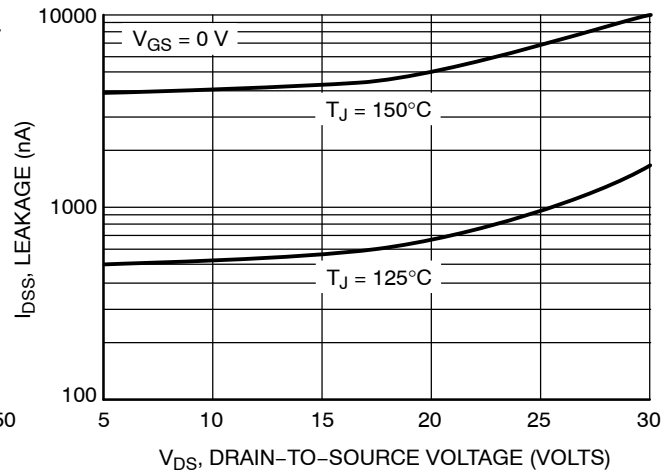


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

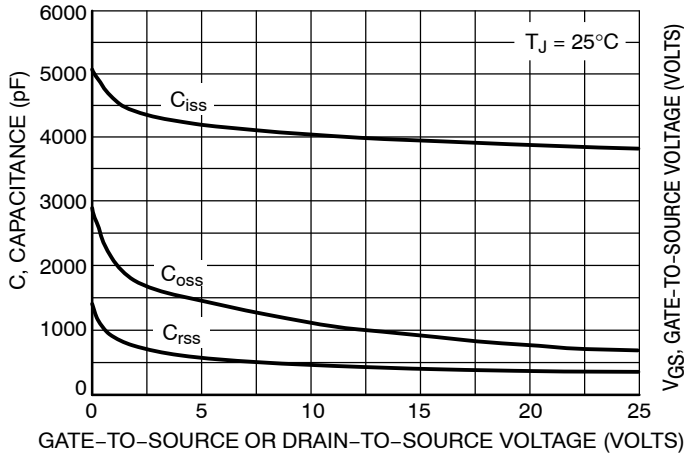


Figure 7. Capacitance Variation

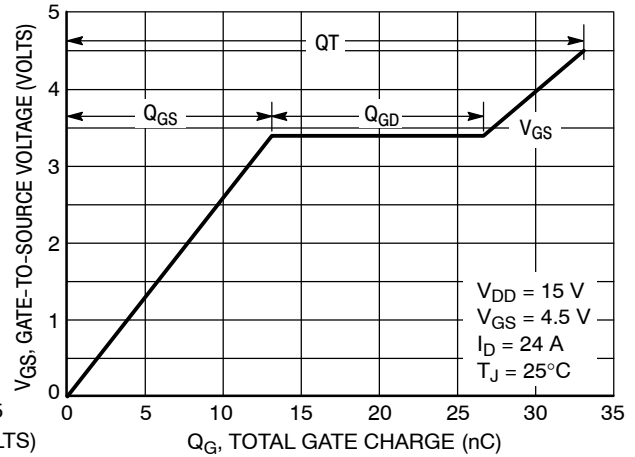


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

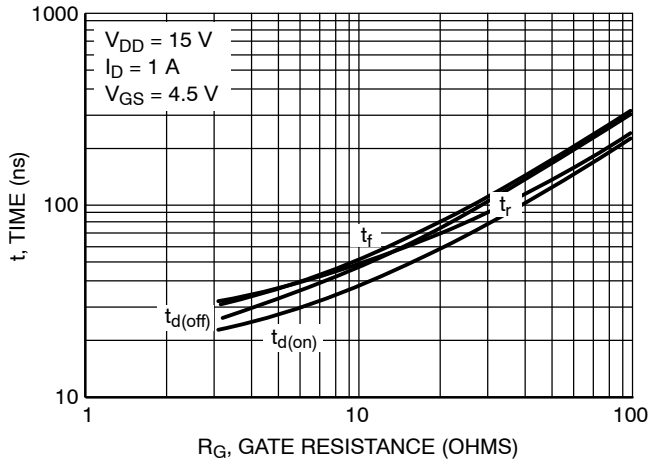


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

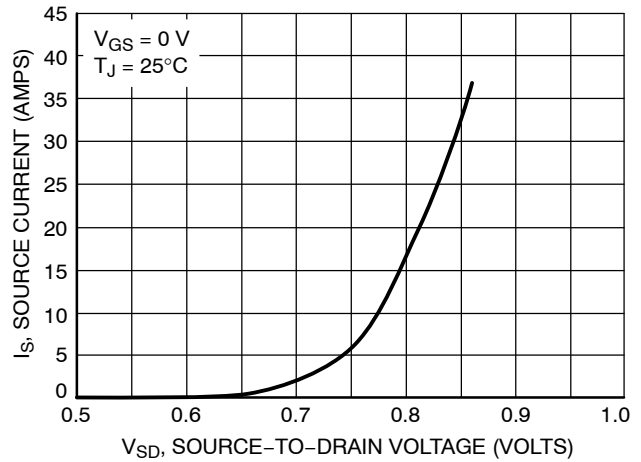


Figure 10. Diode Forward Voltage vs. Current

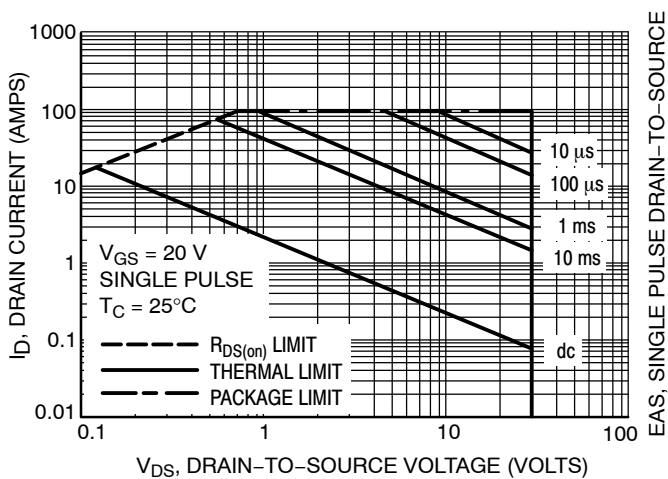


Figure 11. Maximum Rated Forward Biased Safe Operating Area

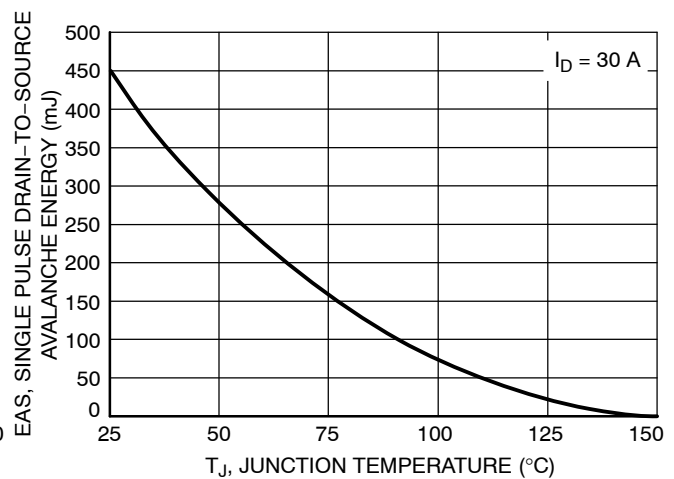


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

NTMFS4120N

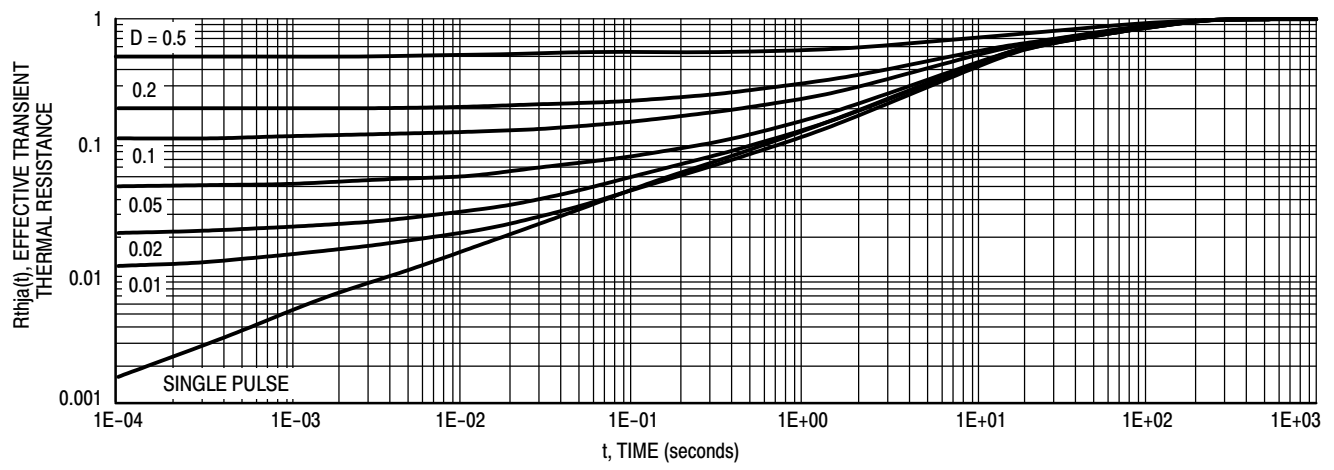


Figure 13. Thermal Response



SCALE 2:1

DFN5 5x6, 1.27P
(SO-8FL)
CASE 488AA
ISSUE N

DATE 25 JUN 2018

NOTES:

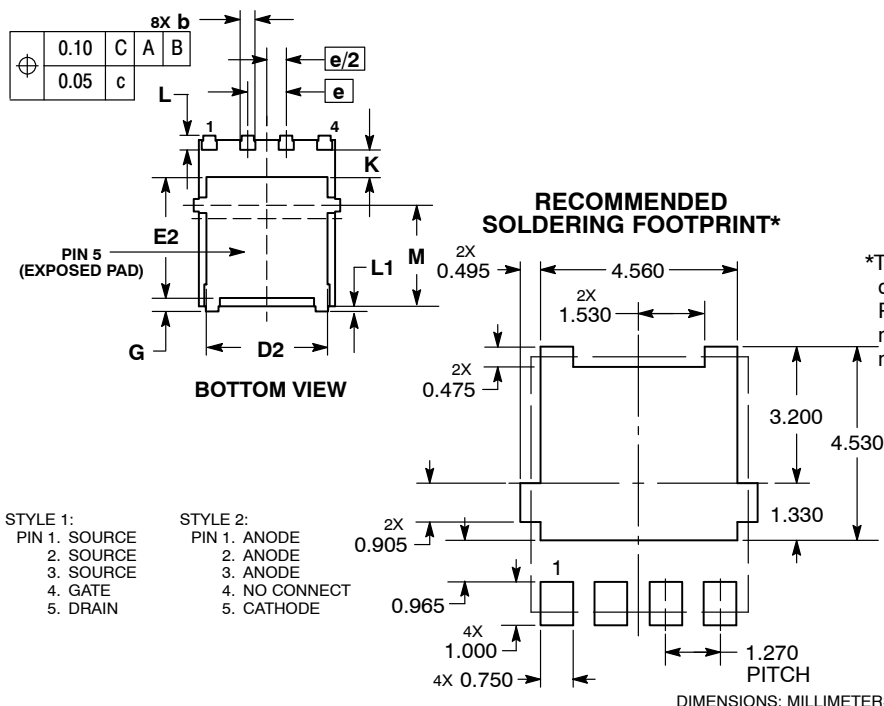
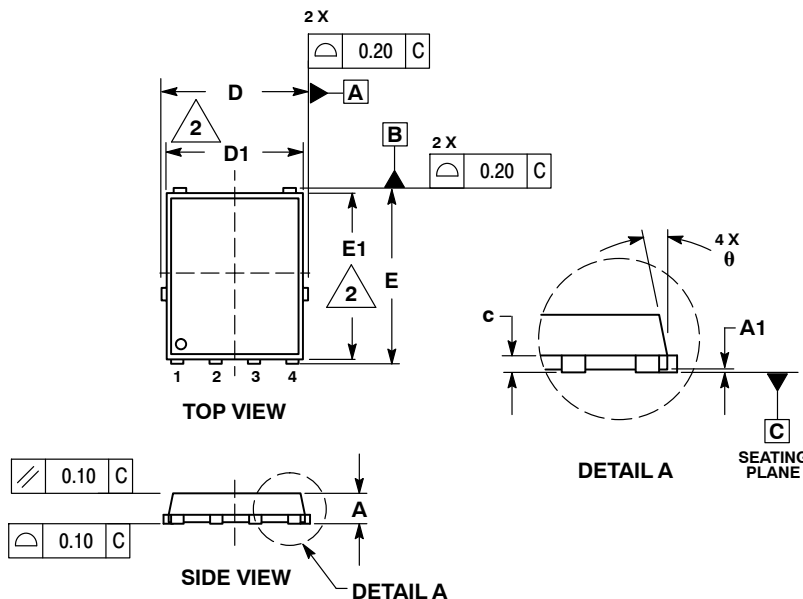
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

| DIM | MILLIMETERS | | |
|-----|-------------|-------|------|
| | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | --- | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.23 | 0.28 | 0.33 |
| D | 5.00 | 5.15 | 5.30 |
| D1 | 4.70 | 4.90 | 5.10 |
| D2 | 3.80 | 4.00 | 4.20 |
| E | 6.00 | 6.15 | 6.30 |
| E1 | 5.70 | 5.90 | 6.10 |
| E2 | 3.45 | 3.65 | 3.85 |
| e | 1.27 BSC | | |
| G | 0.51 | 0.575 | 0.71 |
| K | 1.20 | 1.35 | 1.50 |
| L | 0.51 | 0.575 | 0.71 |
| L1 | 0.125 REF | | |
| M | 3.00 | 3.40 | 3.80 |
| θ | 0° | --- | 12° |

GENERIC
MARKING DIAGRAM*


XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.



STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

STYLE 2:
PIN 1. ANODE
2. ANODE
3. ANODE
4. NO CONNECT
5. CATHODE

*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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