

MOSFET – N-Channel Shielded Gate POWERTRENCH®

150 V, 2 A, 236 mΩ

FDT86246

Description

This N-Channel MOSFET is produced using Fairchild onsemi advanced PowerTrench® Process that has been optimized for $R_{DS(on)}$, switching performance and ruggedness.

Features

- Max $R_{DS(on)}$ = 236 mΩ at $V_{GS} = 10$ V, $I_D = 2$ A
- Max $R_{DS(on)}$ = 329 mΩ at $V_{GS} = 6$ V, $I_D = 1.7$ A
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- Fast Switching Speed
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

Typical Applications

- Load Switch
- Primary Switch

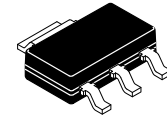
MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Ratings | Unit |
|----------------|--|-------------|------------------|
| V_{DS} | Drain to Source Voltage | 150 | V |
| V_{GS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current –Continuous (Note 1a) | 2 | A |
| | –Pulsed | 8 | |
| E_{AS} | Single Pulse Avalanche Energy (Note 3) | 8 | mJ |
| P_D | Power Dissipation (Note 1a) | 2.2 | W |
| | Power Dissipation (Note 1b) | 1.0 | |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |

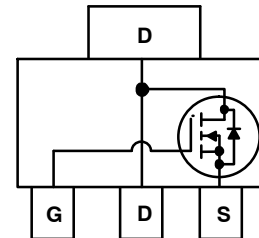
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

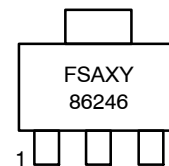
| Symbol | Parameter | Value | Unit |
|-----------------|---|-------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1) | 12 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 55 | |



SOT-223
CASE 318H



MARKING DIAGRAM



Z = Assembly Plan Code
XY = Date Code (Year & week)
86246 = Specific Device Code

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------|----------------------|-----------------------|
| FDT86246 | SOT-223 (Pb-Free) | 4000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

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ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--|--|---|-----|-----|-----------|----------------------------|
| Off Characteristics | | | | | | |
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250 \mu\text{A}$, $V_{GS} = 0 \text{ V}$ | 150 | – | – | V |
| $\frac{\Delta BV_{DSS(th)}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250 \mu\text{A}$, referenced to 25°C | – | 104 | – | $\text{mV}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 120 \text{ V}$, $V_{GS} = 0 \text{ V}$ | – | – | 1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 20 \text{ V}$, $V_{DS} = 0 \text{ V}$ | – | – | ± 100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250 \mu\text{A}$ | 2.0 | 3.1 | 4.0 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250 \mu\text{A}$, referenced to 25°C | – | –9 | – | $\text{mV}/^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10 \text{ V}$, $I_D = 2 \text{ A}$ | – | 194 | 236 | m Ω |
| | | $V_{GS} = 6 \text{ V}$, $I_D = 1.7 \text{ A}$ | – | 231 | 329 | |
| | | $V_{GS} = 10 \text{ V}$, $I_D = 2 \text{ A}$, $T_J = 125^\circ\text{C}$ | – | 349 | 425 | |
| g_{FS} | Forward Transconductance | $V_{DS} = 10 \text{ V}$, $I_D = 2 \text{ A}$ | – | 5 | – | S |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = 75 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | – | 161 | 215 | pF |
| C_{oss} | Output Capacitance | | – | 21 | 30 | pF |
| C_{rss} | Reverse Transfer Capacitance | | – | 1.6 | 5 | pF |
| R_g | Gate Resistance | | – | 0.9 | – | Ω |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 75 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 10 \text{ V}$, $R_{GEN} = 6 \Omega$ | – | 7.8 | 16 | ns |
| t_r | Rise Time | | – | 2.3 | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | – | 4.6 | 10 | ns |
| t_f | Fall Time | | – | 1.2 | 10 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge | $V_{GS} = 0 \text{ V}$ to 10 V , $V_{GS} = 0 \text{ V}$ to 5 V | – | 2.9 | 4 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge | | – | 1.7 | 3 | – |
| Q_{gs} | Total Gate Charge | $V_{DD} = 75 \text{ V}$, $I_D = 2 \text{ A}$ | – | 0.9 | – | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | – | 0.8 | – | nC |

FDT86246

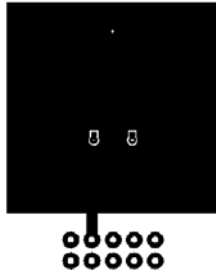
ELECTRICAL CHARACTERISTICS (continued) $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---------------------------------------|---|-----|------|-----|------|
| Drain-Source Diode Characteristics | | | | | | |
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_S = 2\text{ A}$ (Note 2) | - | 0.84 | 1.3 | V |
| t_{rr} | Reverse Recovery Time | $I_F = 2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ | - | 44 | 71 | ns |
| Q_{rr} | Reverse Recovery Charge | | - | 31 | 49 | nC |

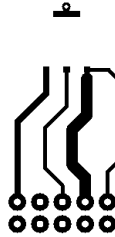
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 55 °C/W when mounted on a 1 in² pad of 2 oz copper



b) 118 °C/W when mounted on a minimum pad of 2 oz copper

- Pulse Test : Pulse Width < 300 μs , Duty Cycle < 2.0%
- Starting $T_J = 25^\circ\text{C}$; N-ch: $L = 1.0\text{ mH}$, $I_{AS} = 4.0\text{ A}$, $V_{DD} = 135\text{ V}$, $V_{GS} = 10\text{ V}$.

TYPICAL CHARACTERISTICS $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

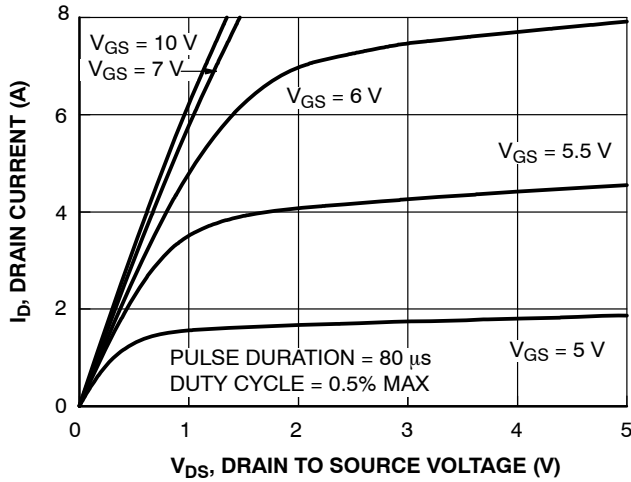


Figure 1. On-Region Characteristics

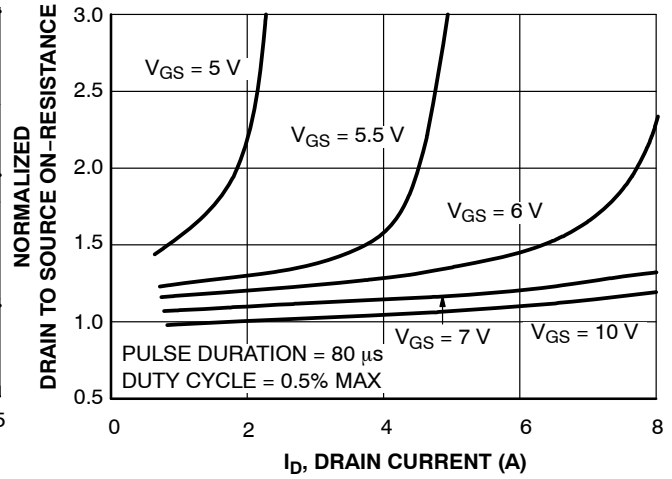


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

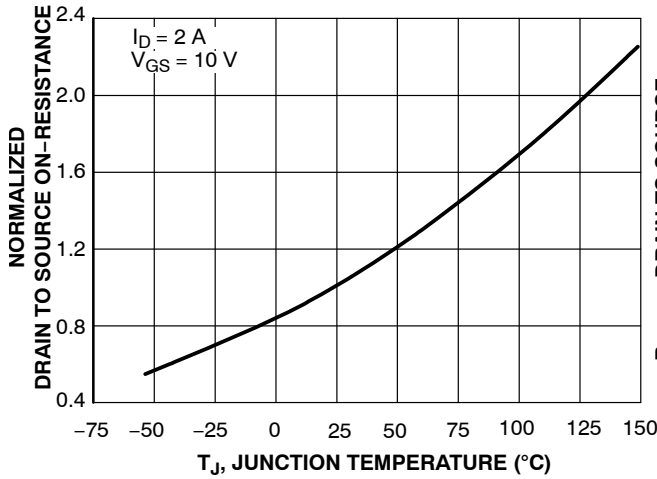


Figure 3. Normalized On Resistance vs. Junction Temperature

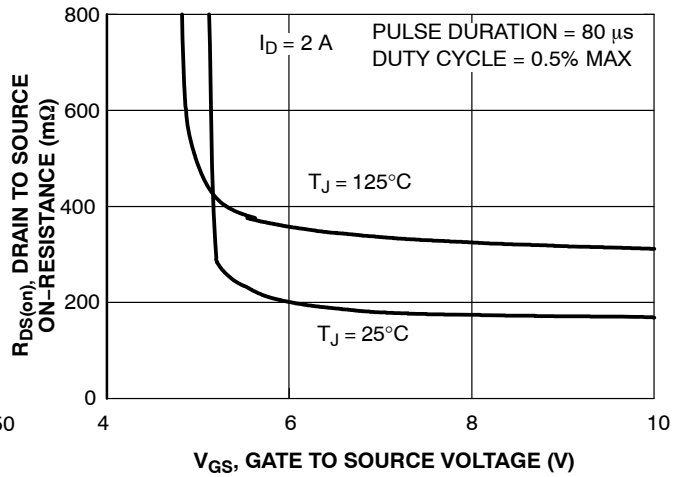


Figure 4. On-Resistance vs. Gate to Source Voltage

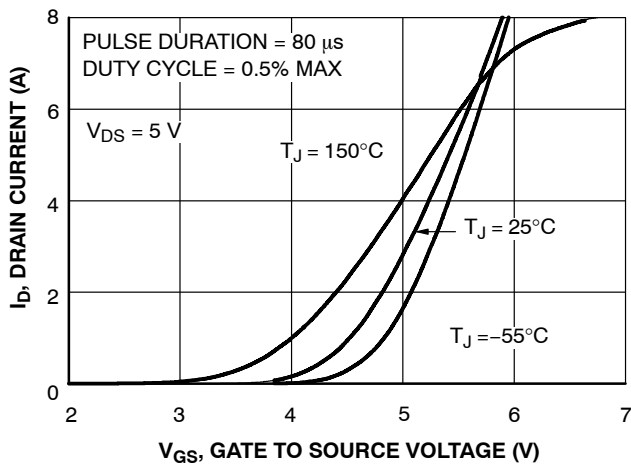


Figure 5. Transfer Characteristics

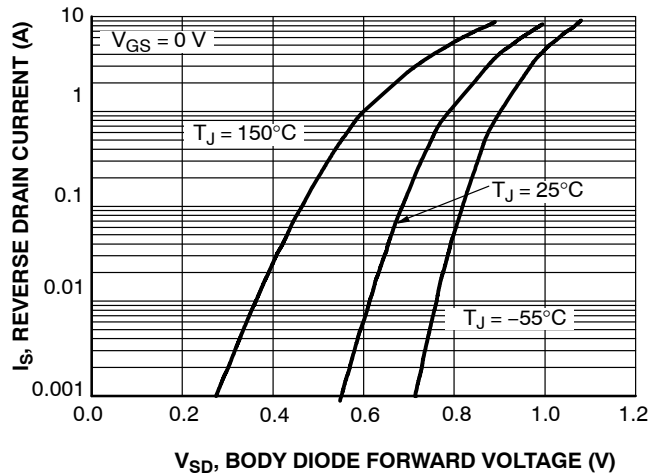


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (CONTINUED) $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

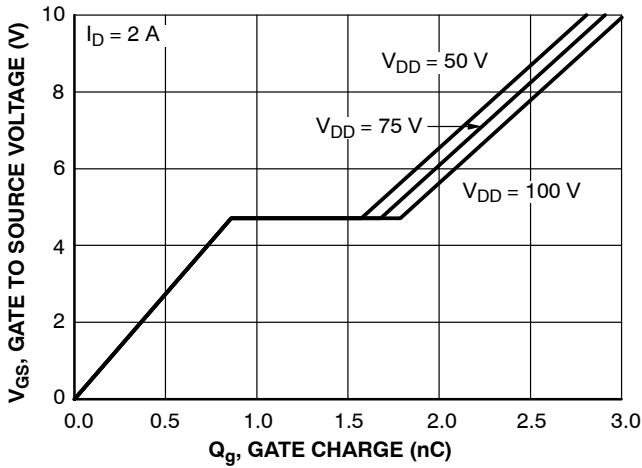


Figure 7. Gate Charge Characteristics

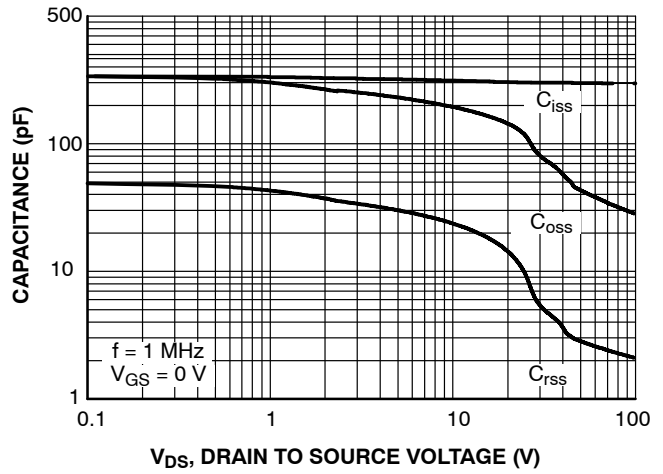


Figure 8. Capacitance vs Drain to Source Voltage

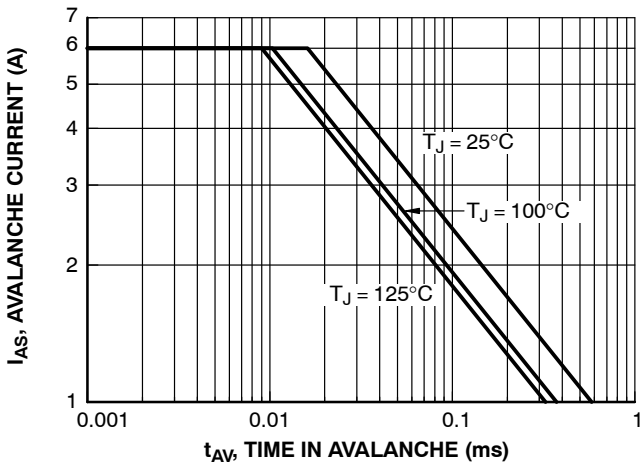


Figure 9. Unclamped Inductive Switching Capability

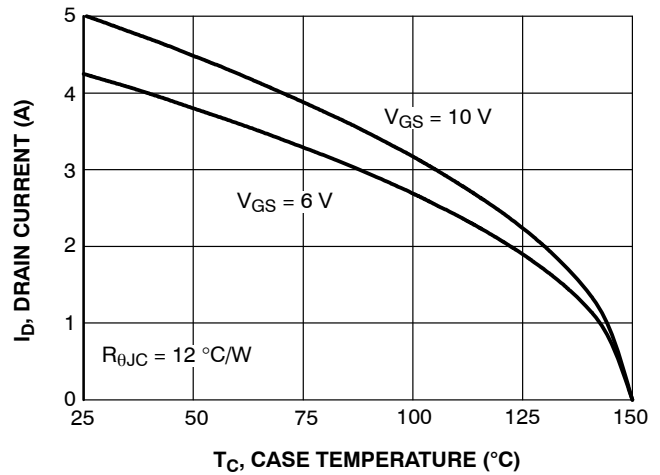


Figure 10. Maximum Continuous Drain Current vs Case Temperature

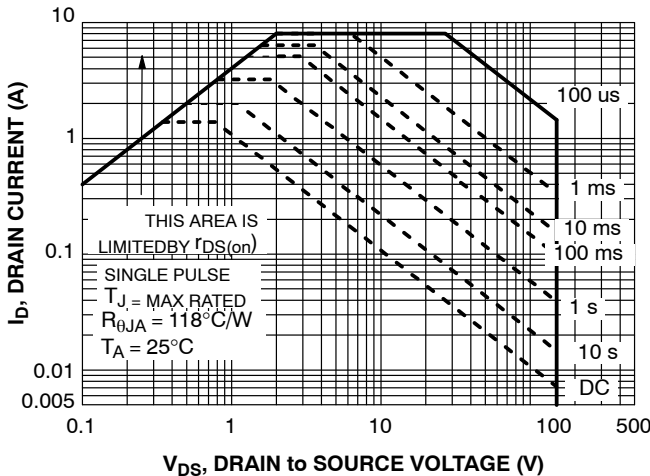


Figure 11. Forward Bias Safe Operating Area

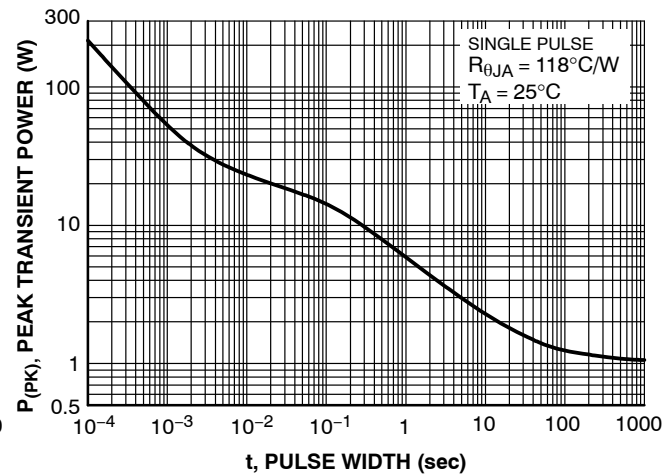


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (CONTINUED) $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED

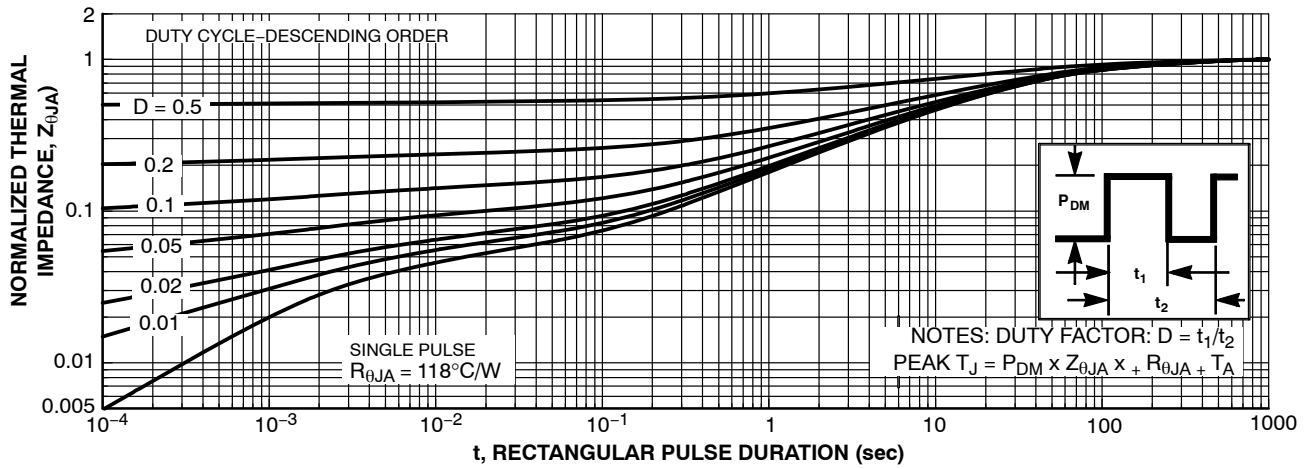
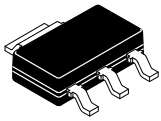


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

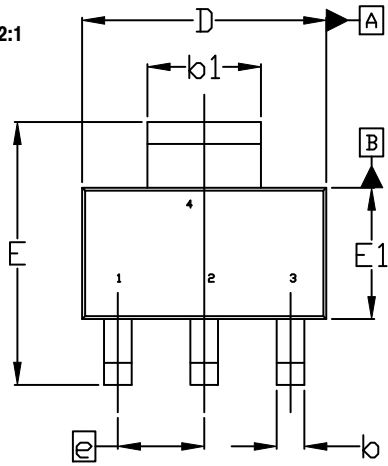
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SOT-223
CASE 318H
ISSUE B

DATE 13 MAY 2020

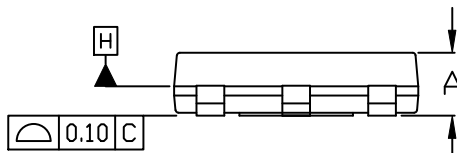
SCALE 2:1



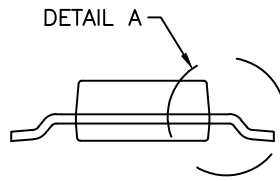
TOP VIEW

$\Phi 0.10 \text{ (M)}$ C A B

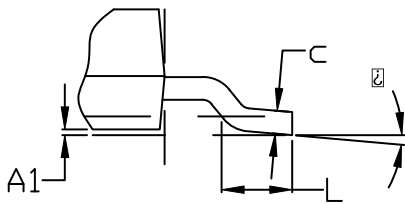
NOTE 7



SIDE VIEW



END VIEW

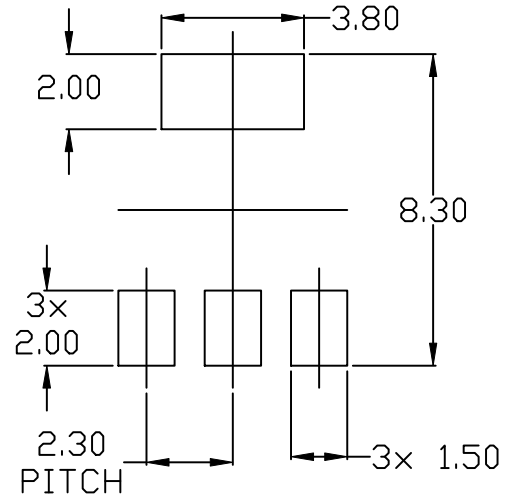


DETAIL A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E1 ARE DETERMINED AT DATUM H. DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. SHALL NOT EXCEED 0.23mm PER SIDE.
4. LEAD DIMENSIONS b AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION IS 0.08mm PER SIDE.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
7. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

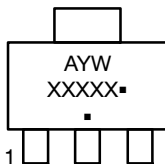
| DIM | MILLIMETERS | | |
|-----------|-------------|------|------|
| | MIN. | NDM. | MAX. |
| A | --- | --- | 1.80 |
| A1 | 0.02 | 0.06 | 0.11 |
| b | 0.60 | 0.74 | 0.88 |
| b1 | 2.90 | 3.00 | 3.10 |
| c | 0.24 | --- | 0.35 |
| D | 6.30 | 6.50 | 6.70 |
| E | 6.70 | 7.00 | 7.30 |
| E1 | 3.30 | 3.50 | 3.70 |
| e | 2.30 BSC | | |
| L | 0.25 | --- | --- |
| \square | 0° | --- | 10° |



RECOMMENDED MOUNTING FOOTPRINT

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

GENERIC MARKING DIAGRAM*



- A = Assembly Location
- Y = Year
- W = Work Week
- XXXXX = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*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.

| | | |
|-------------------------|--------------------|--|
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