

MOSFET – N-Channel QFET®

60 V, 2.8 A, 140 mΩ

FQT13N06

Description

This N-Channel enhancement mode power MOSFET is produced using onsemi's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

Features

- 2.8 A, 60 V, $R_{DS(on)}$ = 140 mΩ (Max) @ V_{GS} = 10 V, I_D = 1.4 A
- Low Gate Charge (Typ. 5.8 nC)
- Low C_{rss} (Typ. 15 pF)
- 100% Avalanche Tested
- This is a Pb-Free Device

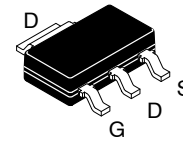
ABSOLUTE MAXIMUM RATINGS

(T_C = 25°C unless otherwise noted)

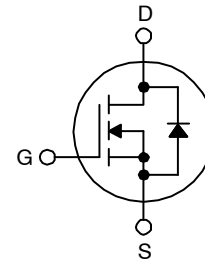
Symbol	Parameter	Value	Unit
V_{DSS}	Drain to Source Voltage	60	V
I_D	Drain Current Continuous (T_C = 25°C) Continuous (T_C = 70°C)	2.8 2.24	A
I_{DM}	Drain Current – Pulsed (Note 1)	11.2	A
V_{GSS}	Gate to Source Voltage	±25	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	85	mJ
I_{AR}	Avalanche Current (Note 1)	2.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.21	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	7.0	V/ns
P_D	Power Dissipation (T_C = 25°C) Derate above 25°C	2.1 0.017	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	–55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purposes, 1/8" from Case for 5 Seconds	300	°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.

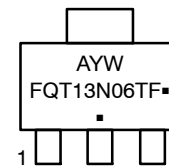
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. L = 12.6 mH, I_{AS} = 2.8 A, V_{DD} = 25 V, R_G = 25 Ω, Starting T_J = 25°C.
3. I_{SD} ≤ 13 A, di/dt ≤ 300 A/μs, V_{DD} ≤ BV_{DSS} , Starting T_J = 25°C.



SOT-223
CASE 318H-01



MARKING DIAGRAM



- A = Assembly Location
Y = Year
W = Work Week
FQT13N06TF = Specific Device Code
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
FQT13N06TF	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.

FQT13N06

THERMAL CHARACTERISTICS

Symbol	Parameter	Min	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient*	–	60	°C/W

*When mounted on the minimum pad size recommended (PCB Mount)

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTIC

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	60	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	–	0.6	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 60\ \text{V}$, $V_{GS} = 0\ \text{V}$	–	–	1	μA
		$V_{DS} = 48\ \text{V}$, $T_C = 150^\circ\text{C}$	–	–	10	
I_{GSSF}	Gate to Body Leakage Current, Forward	$V_{GS} = 25\ \text{V}$, $V_{DS} = 0\ \text{V}$	–	–	100	nA
I_{GSSR}	Gate to Body Leakage Current, Reverse	$V_{GS} = -25\ \text{V}$, $V_{DS} = 0\ \text{V}$	–	–	-100	

ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	2.0	–	4.0	V
$R_{DS(on)}$	Static Drain to Source On-Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 1.4\ \text{A}$	–	0.11	0.14	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 25\ \text{V}$, $I_D = 1.4\ \text{A}$ (Note 4)	–	3.0	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1.0\ \text{MHz}$	–	240	310	pF
C_{oss}	Output Capacitance		–	90	120	pF
C_{rss}	Reverse Transfer Capacitance		–	15	20	pF

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\ \text{V}$, $I_D = 6.5\ \text{A}$, $R_G = 25\ \Omega$ (Note 4 and 5)	–	5	20	ns
t_r	Turn-On Rise Time		–	25	60	ns
$t_{d(off)}$	Turn-Off Delay Time		–	8	25	ns
t_f	Turn-Off Fall Time		–	15	40	ns
Q_g	Total Gate Charge	$V_{DS} = 48\ \text{V}$, $I_D = 13\ \text{A}$, $V_{GS} = 10\ \text{V}$ (Note 4 and 5)	–	5.8	7.5	nC
Q_{gs}	Gate to Source Charge		–	2.0	–	nC
Q_{gd}	Gate to Drain Charge		–	2.5	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain to Source Diode Forward Current		–	–	2.8	A
I _{SM}	Maximum Pulsed Drain to Source Diode Forward Current		–	–	11.2	A
V _{SD}	Drain to Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.8 A	–	–	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 13 A, dI _F /dt = 100 A/μs (Note 4)	–	39	–	ns
Q _{rr}	Reverse Recovery Charge		–	40	–	μC

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.

4. Pulse Test: Pulse width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

5. Essentially Independent of Operating Temperature.

TYPICAL CHARACTERISTICS

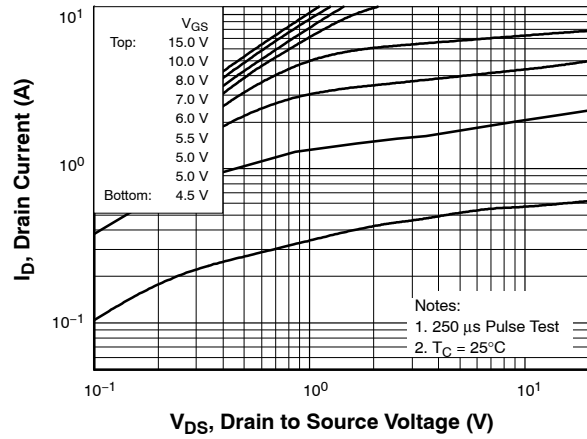


Figure 1. On-Region Characteristics

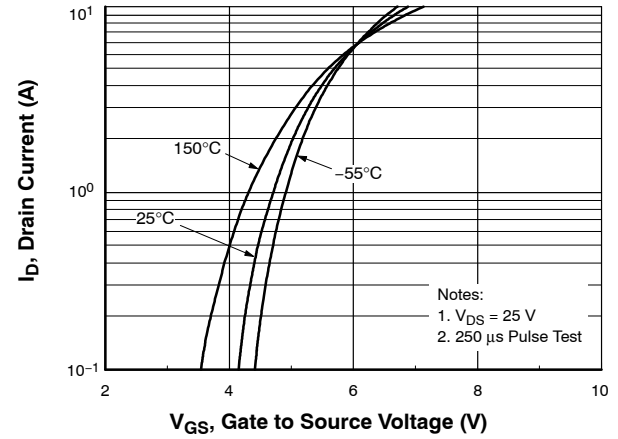


Figure 2. Transfer Characteristics

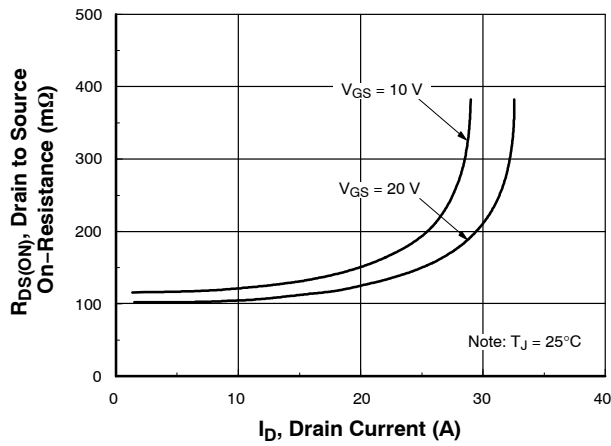


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

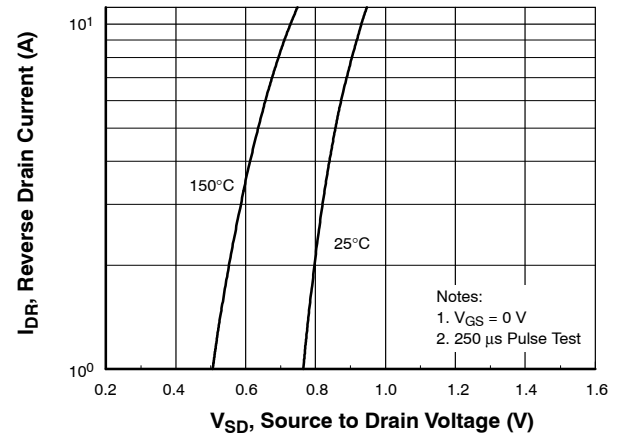


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

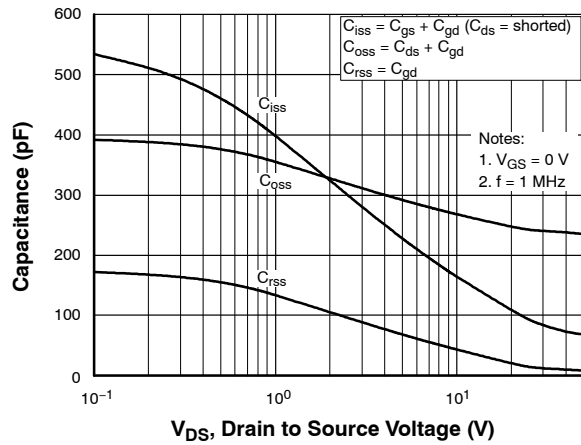


Figure 5. Capacitance Characteristics

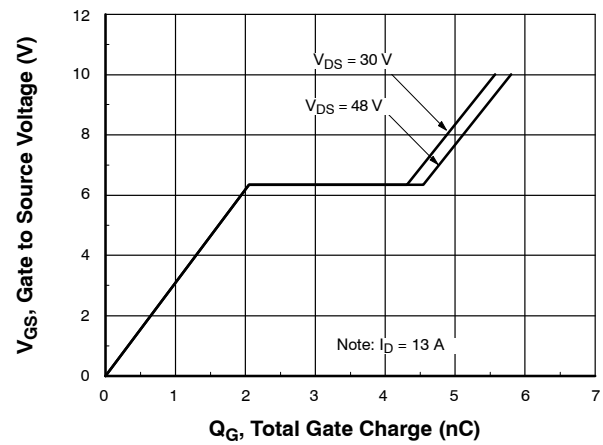


Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (Continued)

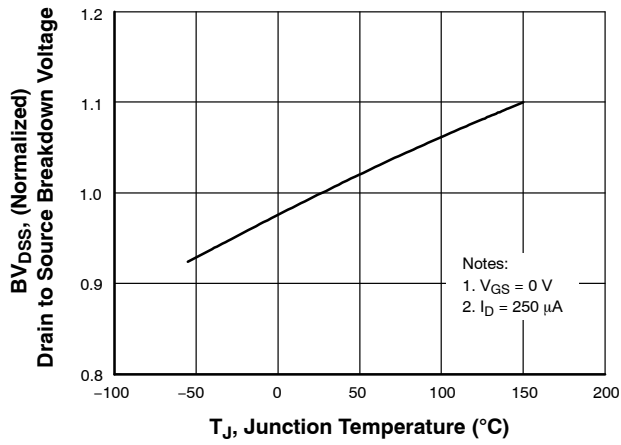


Figure 7. Breakdown Voltage Variation vs. Temperature

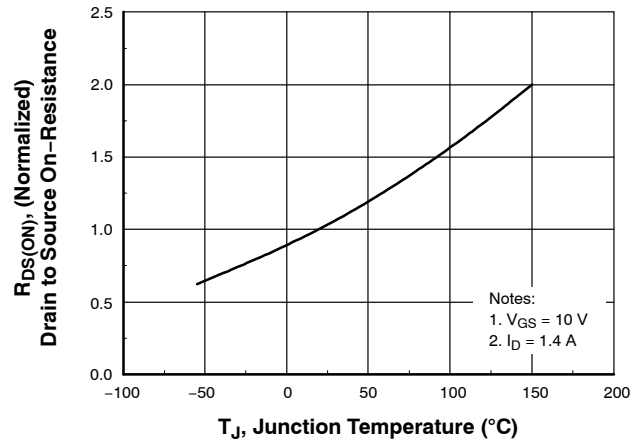


Figure 8. On-Resistance Variation vs. Temperature

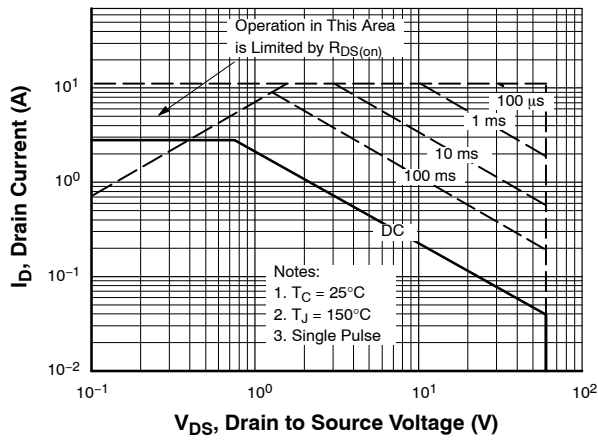


Figure 9. Maximum Safe Operating Area

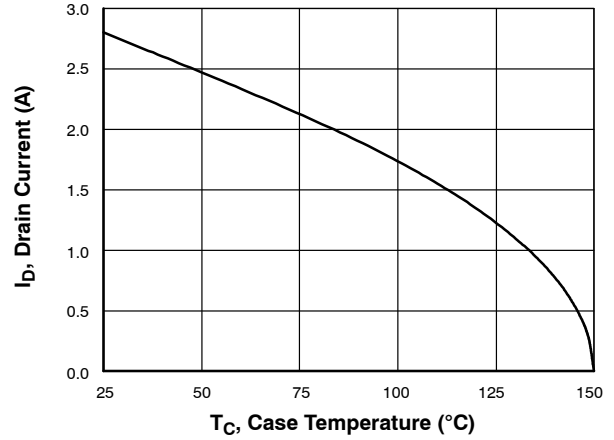


Figure 10. Maximum Drain Current vs. Case Temperature

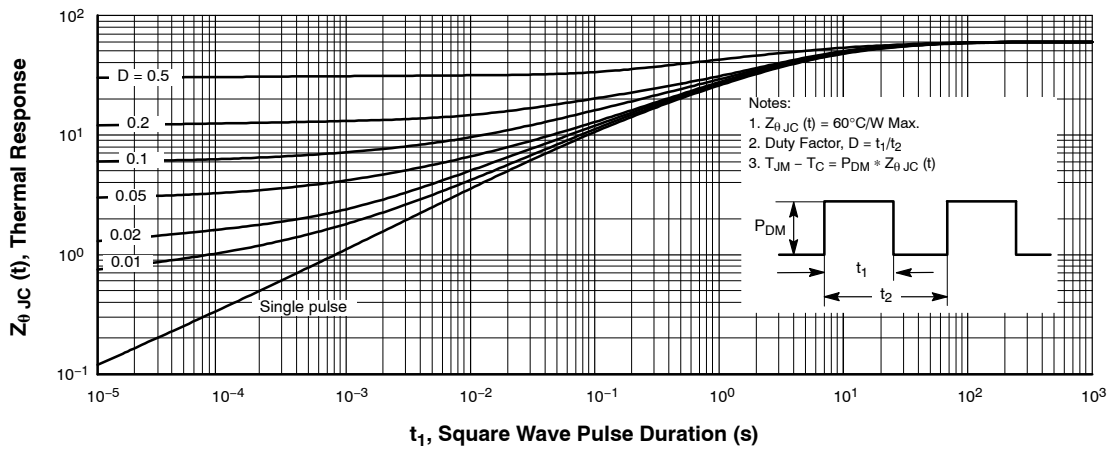


Figure 11. Transient Thermal Response Curve

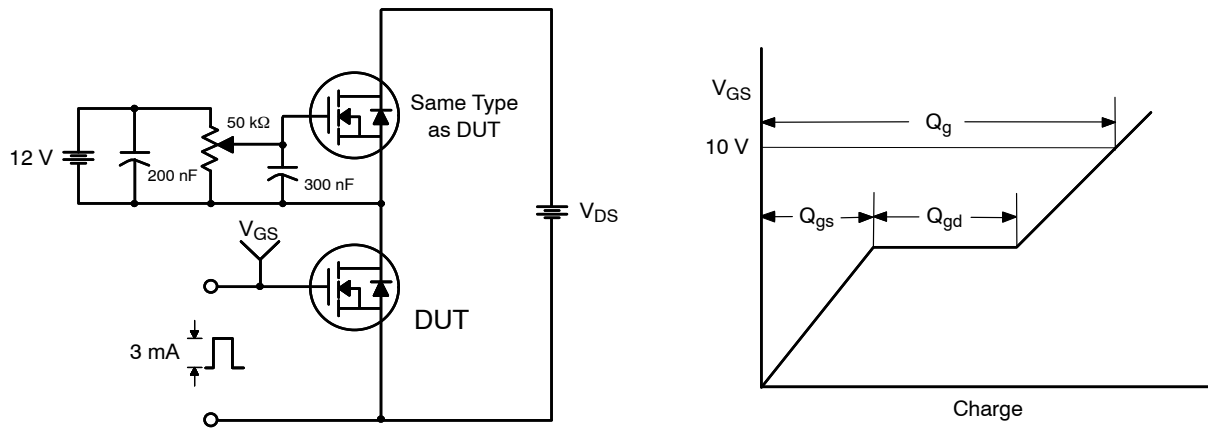


Figure 12. Gate Charge Test Circuit & Waveform

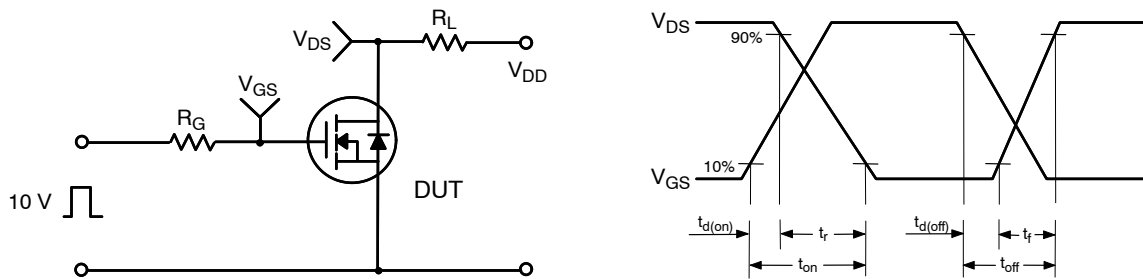


Figure 13. Resistive Switching Test Circuit & Waveforms

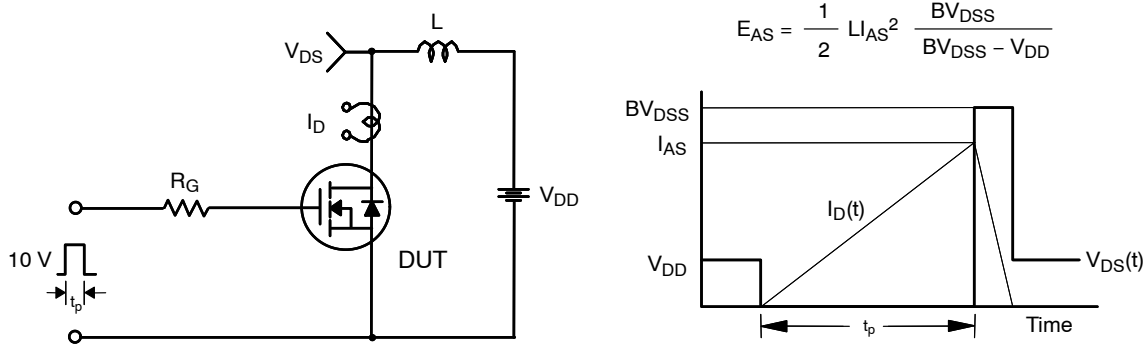


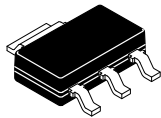
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

The circuit diagram shows a MOSFET (DUT) with its source connected to ground and its drain connected to a load inductor L and a supply V_{DD} . A driver MOSFET, of the same type as the DUT, is used to switch the DUT's gate. The driver's gate is driven by a square wave V_{GS} through a gate resistor R_G . The DUT's drain current is I_{SD} and its drain-source voltage is V_{DS} . The DUT's body diode is represented by a diode symbol in the drain-source path.

The waveforms show the following:

- V_{GS} (Driver):** A square wave pulse. The duty cycle is defined as $D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$. The pulse height is 10 V.
- I_{SD} (DUT):** The drain current. It rises during the gate pulse to a forward current I_{FM} (Body Diode Forward Current). When the gate pulse ends, the current falls through the diode in reverse, showing a reverse current I_{RM} (Body Diode Reverse Current) and a di/dt slope.
- V_{DS} (DUT):** The drain-source voltage. It drops to a forward voltage drop V_{SD} (Body Diode Forward Voltage Drop) during the pulse. After the pulse, it rises during the body diode recovery, showing a dv/dt (Body Diode Recovery dv/dt), before settling at V_{DD} .

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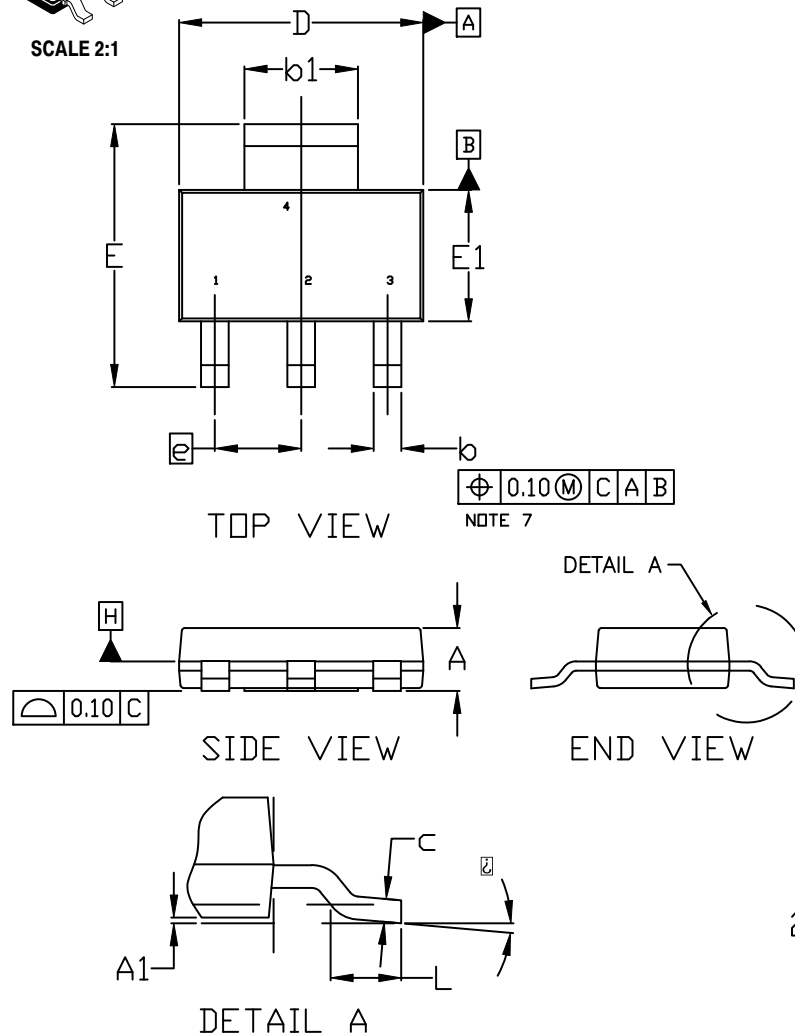
SCALE 2:1

SOT-223
CASE 318H
ISSUE B

DATE 13 MAY 2020

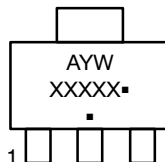
NOTES:

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.	NOM.	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	---	---
⌀	0°	---	10°

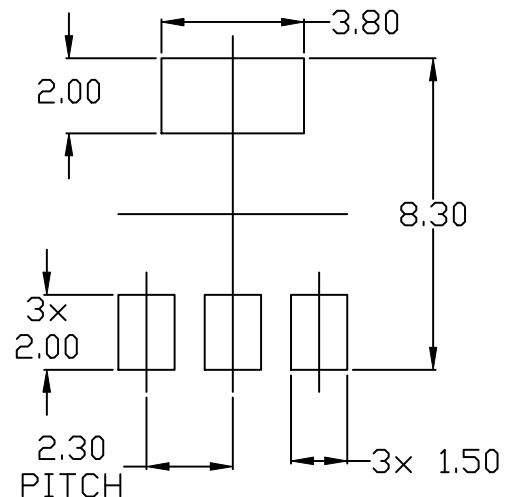
GENERIC MARKING DIAGRAM*



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.



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.

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