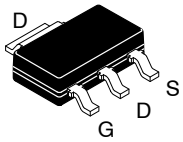
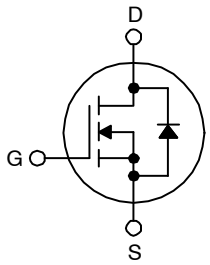
MOSFET – N-Channel QFET®

60 V, 2.8 A, 140 mΩ

FQT13N06



SOT−223
CASE 318H−01



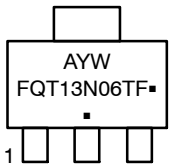
Description

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 Crss (Typ. 15 pF)
- 100% Avalanche Tested
- This is a Pb−Free Device

MARKING DIAGRAM



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

(Note: Microdot may be in either location)

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. $I_{SD} \leq 13$ A, di/dt ≤ 300 A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C.

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.

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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°C, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTIC						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250 μA, V_{GS} = 0 V	60	–	–	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	0.6	–	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 60 V, V_{GS} = 0 V	–	–	1	μA
		V_{DS} = 48 V, T_C = 150°C	–	–	10	
I_{GSSF}	Gate to Body Leakage Current, Forward	V_{GS} = 25 V, V_{DS} = 0 V	–	–	100	nA
I_{GSSR}	Gate to Body Leakage Current, Reverse	V_{GS} = −25 V, V_{DS} = 0 V	–	–	−100	
ON CHARACTERISTICS						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	2.0	–	4.0	V
$R_{DS(on)}$	Static Drain to Source On−Resistance	V_{GS} = 10 V, I_D = 1.4 A	–	0.11	0.14	Ω
g_{FS}	Forward Transconductance	V_{DS} = 25 V, I_D = 1.4 A (Note 4)	–	3.0	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 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 V, I_D = 6.5 A, R_G = 25 Ω (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 V, I_D = 13 A, V_{GS} = 10 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 ≤ 300 μs, Duty Cycle ≤ 2%.
5. Essentially Independent of Operating Temperature.

TYPICAL CHARACTERISTICS

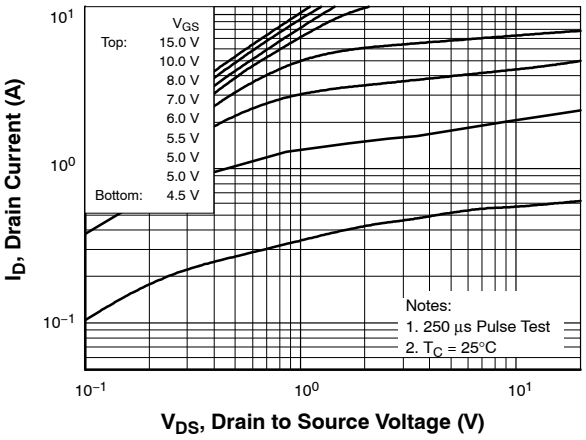

Figure 1. On−Region Characteristics

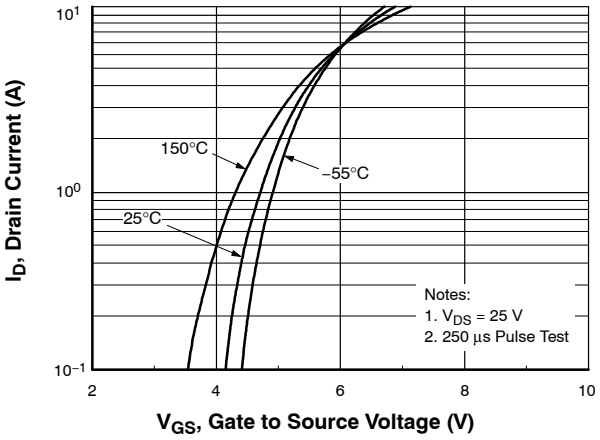

Figure 2. Transfer Characteristics

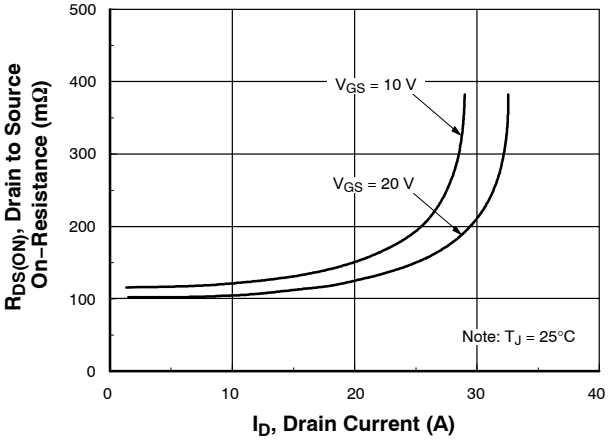

Figure 3. On−Resistance Variation vs. Drain Current and Gate Voltage

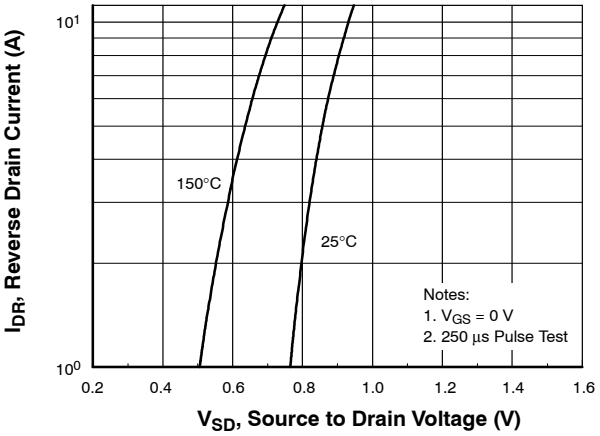

Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

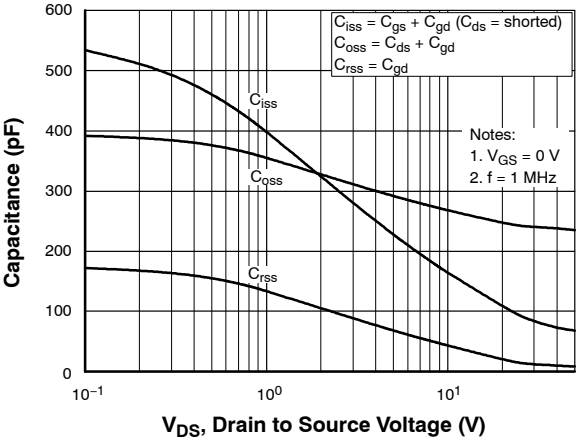

Figure 5. Capacitance Characteristics

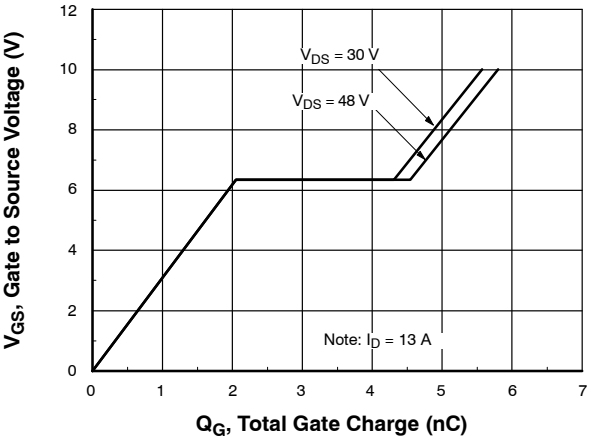

Figure 6. Gate Charge Characteristics

TYPICAL CHARACTERISTICS (Continued)

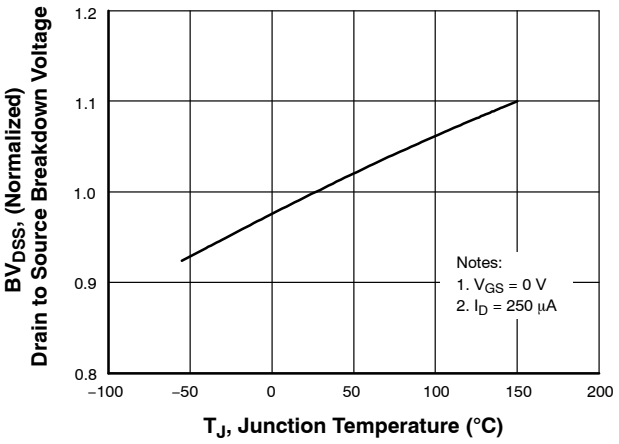

Figure 7. Breakdown Voltage Variation vs. Temperature

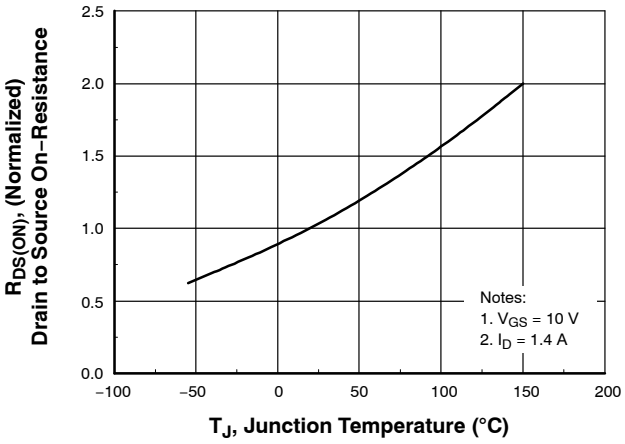

Figure 8. On−Resistance Variation vs. Temperature

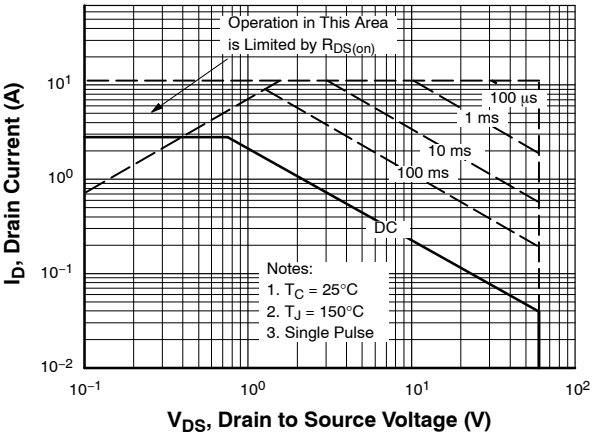

Figure 9. Maximum Safe Operating Area

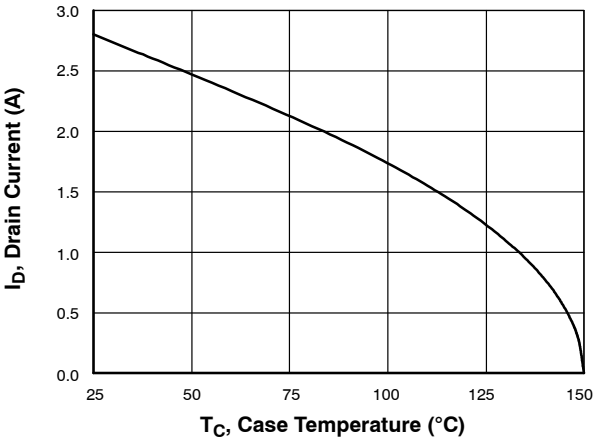

Figure 10. Maximum Drain Current vs. Case Temperature

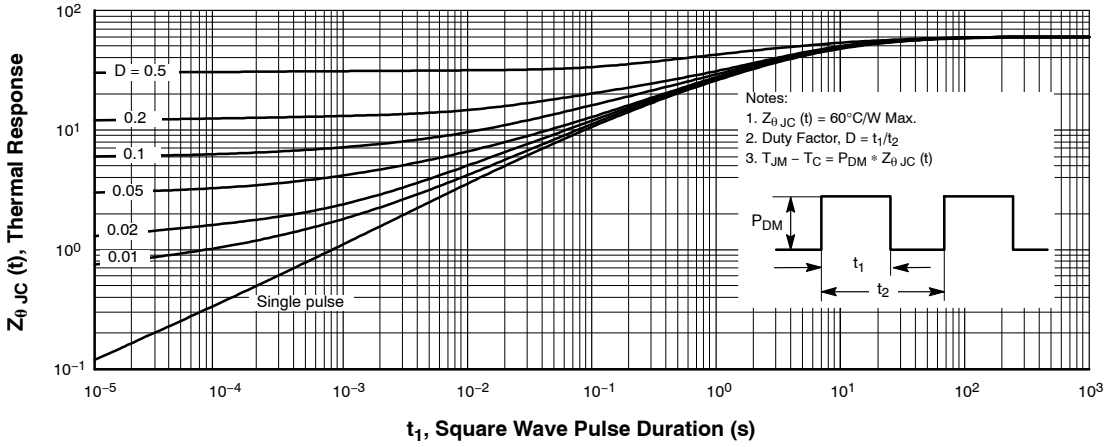

Figure 11. Transient Thermal Response Curve

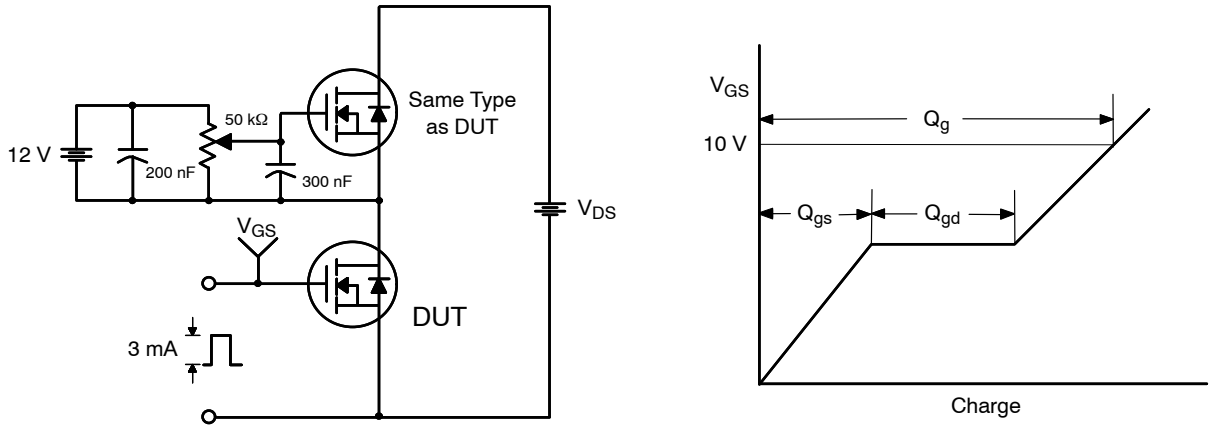

Figure 12. Gate Charge Test Circuit & Waveform

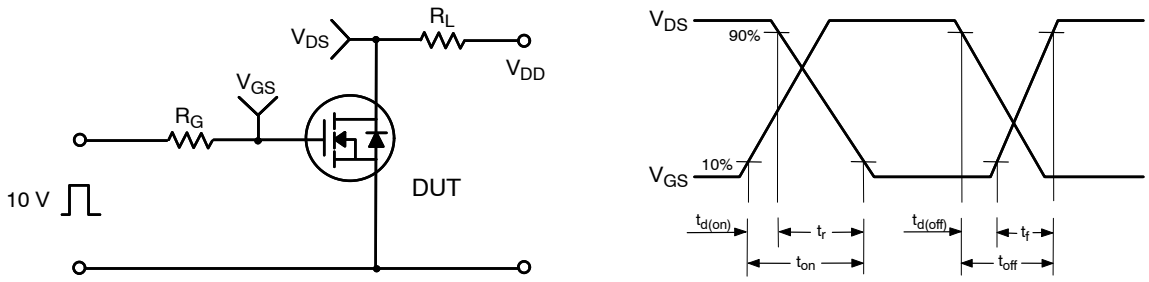

Figure 13. Resistive Switching Test Circuit & Waveforms

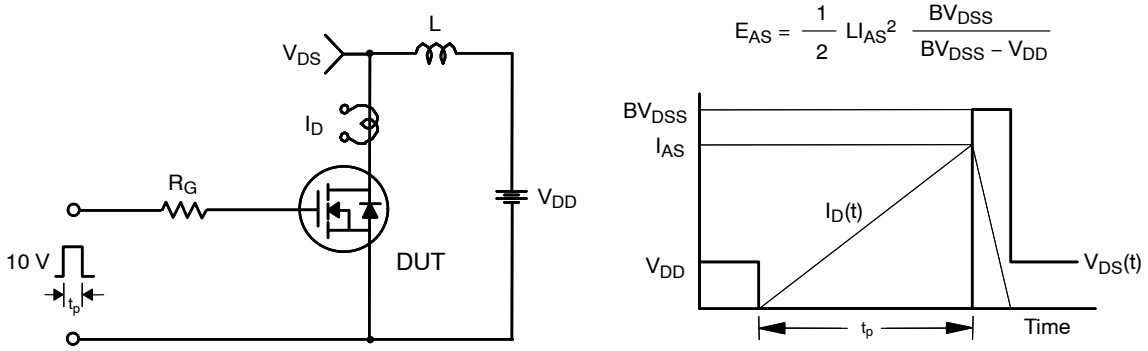

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

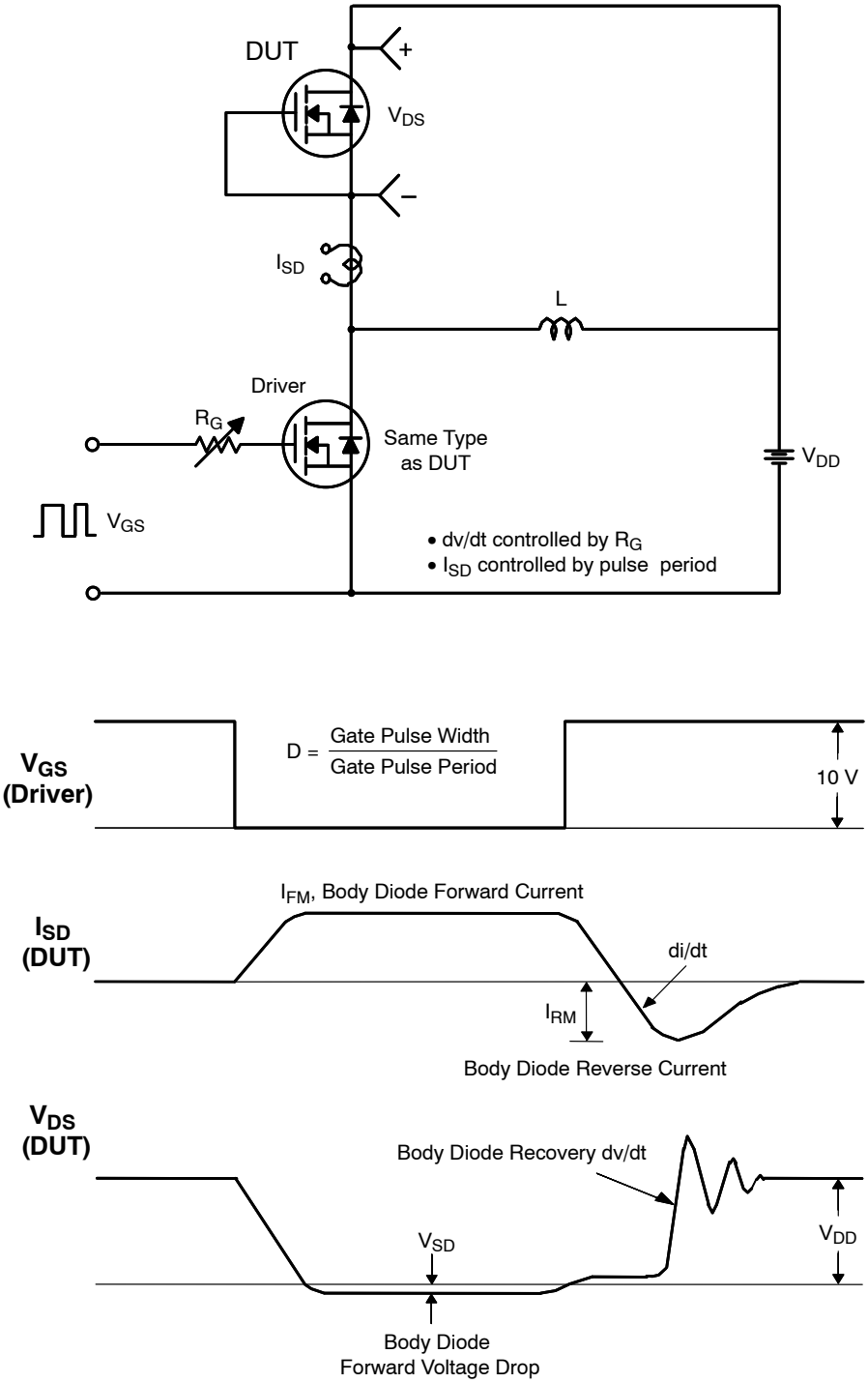

Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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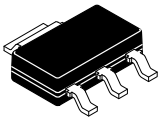
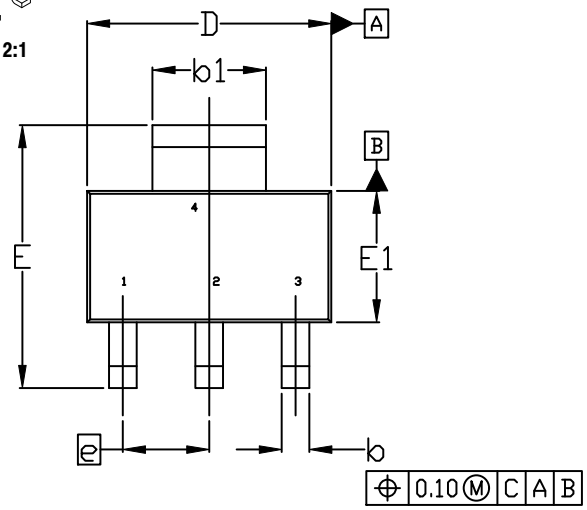
SOT−223
CASE 318H
ISSUE B

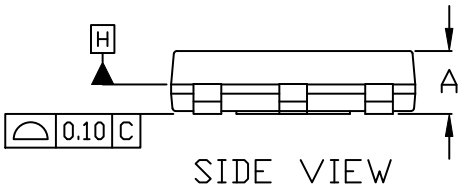
DATE 13 MAY 2020



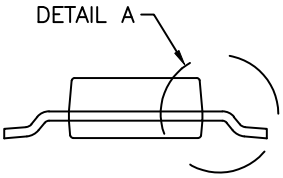
SCALE 2:1



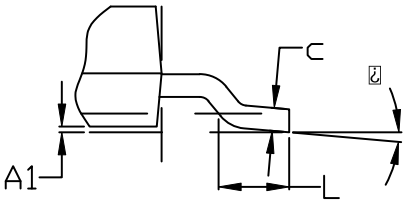
TOP VIEW



SIDE VIEW



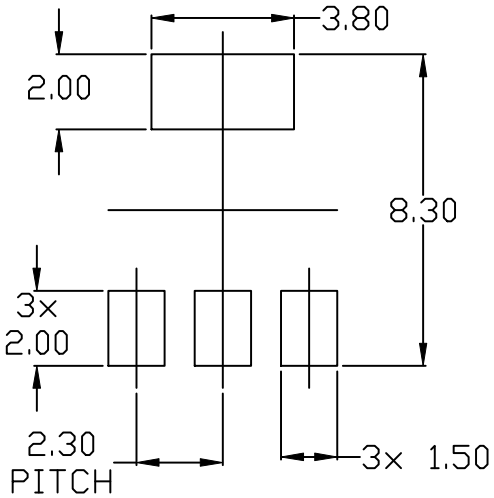
END VIEW



DETAIL A

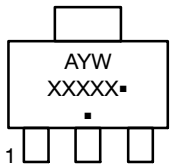
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E1 ARE DETERMINED AT DATUM H. DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. SHALL NOT EXCEED 0.23mm PER SIDE.
4. LEAD DIMENSIONS b AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBBAR 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	---	---
θ	0°	---	10°



RECOMMENDED MOUNTING FOOTPRINT

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.

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

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