

# MOSFET – Power, Dual, N-Channel, for 1-Cell Lithium-ion Battery Protection

12 V, 2.75 mΩ, 33 A



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## EFC2K102ANUZ

### Overview

This Power MOSFET features a low on-state resistance. This device is suitable for applications such as power switches of portable machines. Best suited for 1-cell lithium-ion battery applications.

### Features

- 2.5 V Drive
- Common-Drain type
- ESD Diode-Protected Gate
- Pb-Free, Halogen Free and RoHS Compliance

### Applications

- 1-Cell Lithium-ion Battery Charging and Discharging Switch

### Specifications

#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Parameter	Symbol	Value	Unit
Source to Source Voltage	V <sub>SSS</sub>	12	V
Gate to Source Voltage	V <sub>GSS</sub>	±8	V
Source Current (DC)	I <sub>S</sub>	33	A
Source Current (Pulse) PW ≤ 10 μs, duty cycle ≤ 1%	I <sub>SP</sub>	135	A
Total Dissipation (Note 1)	P <sub>T</sub>	3.1	W
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°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.

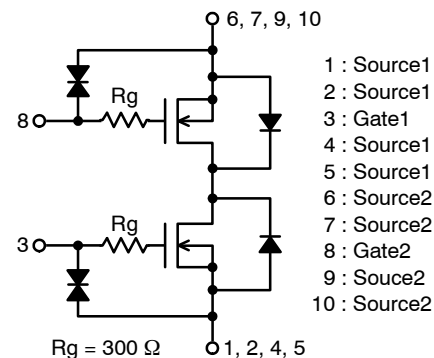
#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 1)	R <sub>θJA</sub>	40.3	°C/W

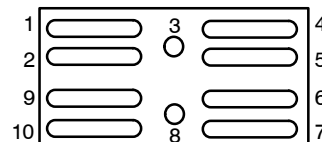
1. Surface mounted on ceramic substrate (5000 mm<sup>2</sup> × 0.8 mm).

V <sub>SSS</sub>	R <sub>SS(on)</sub> Max	I <sub>S</sub> Max
12 V	2.75 mΩ @ 4.5 V	33 A
	2.85 mΩ @ 3.8 V	
	3.95 mΩ @ 3.1 V	
	6.1 mΩ @ 2.5 V	

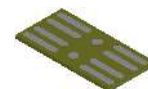
### ELECTRICAL CONNECTION N-Channel



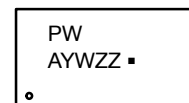
### PIN ASSIGNMENT



### MARKING DIAGRAM



WLCSP10  
2.98x1.49x0.1  
CASE 567ZG



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

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# EFC2K102ANUZ

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Source to Source Breakdown Voltage	$V_{(BR)SSS}$	$I_S = 1 \text{ mA}, V_{GS} = 0 \text{ V}$ Test Circuit 1	12	-	-	V
Zero-Gate Voltage Source Current	$I_{SSS}$	$V_{SS} = 10 \text{ V}, V_{GS} = 0 \text{ V}$ Test Circuit 1	-	-	1	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 8 \text{ V}, V_{SS} = 0 \text{ V}$ Test Circuit 2	-	-	$\pm 1$	$\mu\text{A}$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{SS} = 6 \text{ V}, I_S = 1 \text{ mA}$ Test Circuit 3	0.4	-	1.3	V
Static Source to Source On-State Resistance	$R_{SS(on)}$	$I_S = 5 \text{ A}, V_{GS} = 4.5 \text{ V}$ Test Circuit 4	1.55	2.10	2.75	$\text{m}\Omega$
		$I_S = 5 \text{ A}, V_{GS} = 3.8 \text{ V}$ Test Circuit 4	1.60	2.20	2.85	$\text{m}\Omega$
		$I_S = 5 \text{ A}, V_{GS} = 3.1 \text{ V}$ Test Circuit 4	1.65	2.40	3.95	$\text{m}\Omega$
		$I_S = 5 \text{ A}, V_{GS} = 2.5 \text{ V}$ Test Circuit 4	1.90	3.10	6.10	$\text{m}\Omega$
Turn-ON Delay Time	$t_{d(on)}$	$V_{SS} = 6 \text{ V}, V_{GS} = 3.8 \text{ V}, I_S = 5 \text{ A},$ $R_g = 10 \text{ k}\Omega$ Test Circuit 5	-	20	-	$\mu\text{s}$
Rise Time	$t_r$		-	58	-	$\mu\text{s}$
Turn-OFF Delay Time	$t_{d(off)}$		-	115	-	$\mu\text{s}$
Fall Time	$t_f$		-	94	-	$\mu\text{s}$
Total Gate Charge	$Q_g$	$V_{SS} = 6 \text{ V}, V_{GS} = 3.8 \text{ V}, I_S = 5 \text{ A}$	-	42	-	nC
Forward Source to Source Voltage	$V_{F(S-S)}$	$I_S = 3 \text{ A}, V_{GS} = 0 \text{ V}$ Test Circuit 7	-	0.75	1.20	V

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.

TYPICAL CHARACTERISTICS

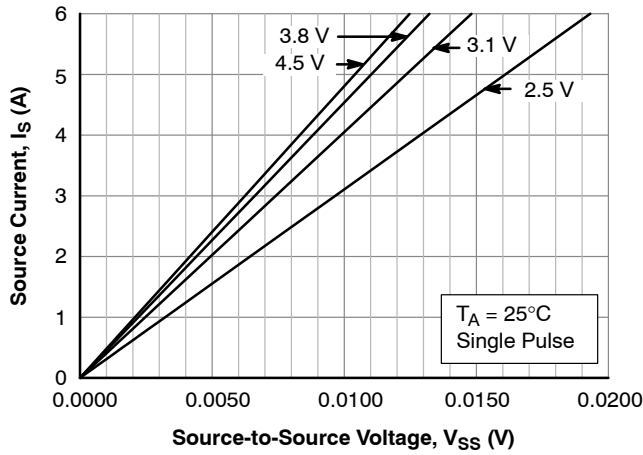


Figure 1.  $I_S - V_{SS}$

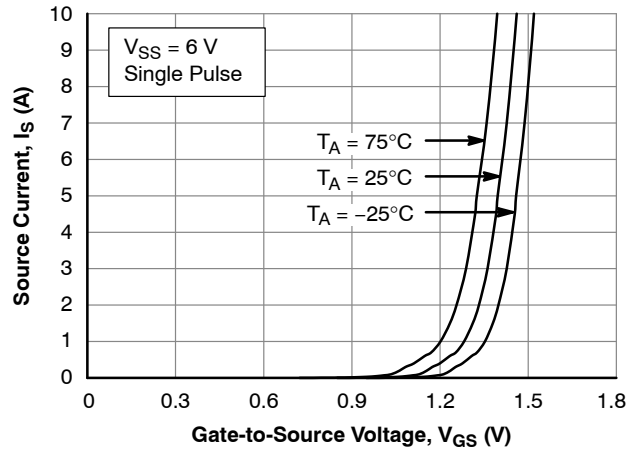


Figure 2.  $I_S - V_{GS}$

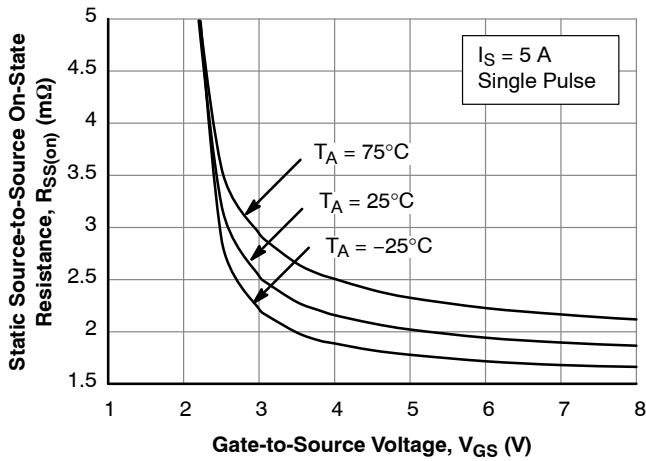


Figure 3.  $R_{SS(on)} - V_{GS}$

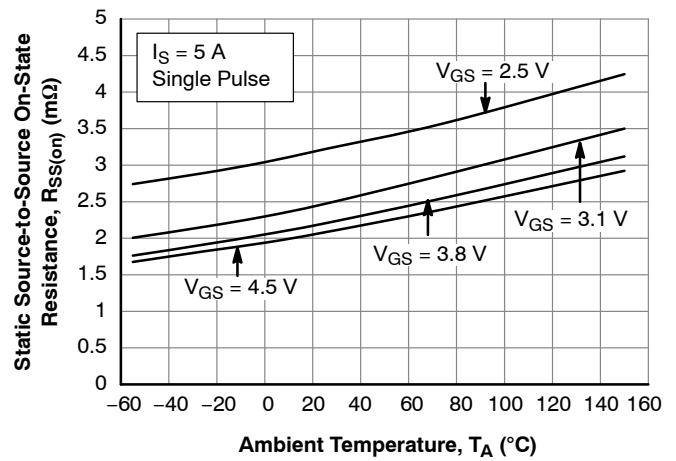


Figure 4.  $R_{SS(on)} - T_A$

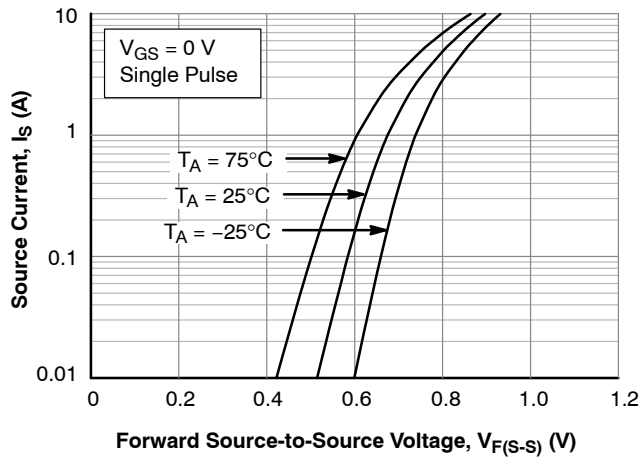


Figure 5.  $I_S - V_{F(S-S)}$

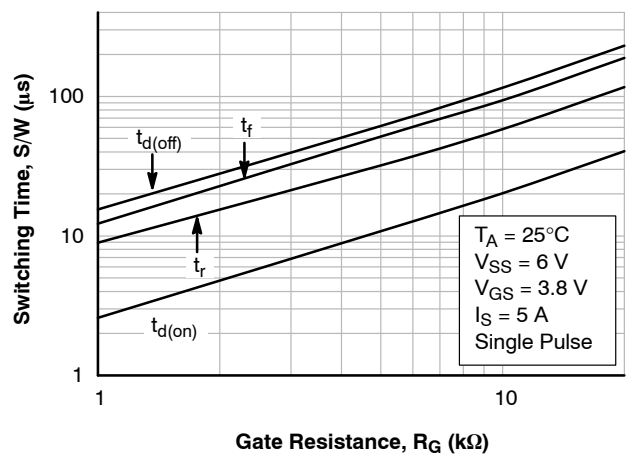


Figure 6. SW Time -  $R_G$

# EFC2K102ANUZ

## TYPICAL CHARACTERISTICS (Continued)

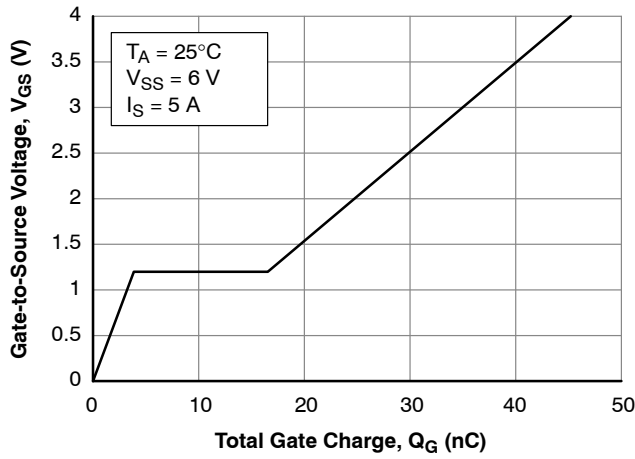


Figure 7.  $V_{GS} - Q_G$

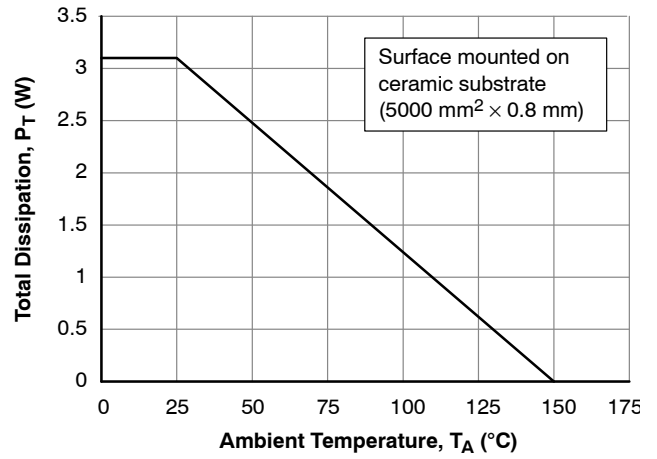


Figure 8.  $P_T - T_A$

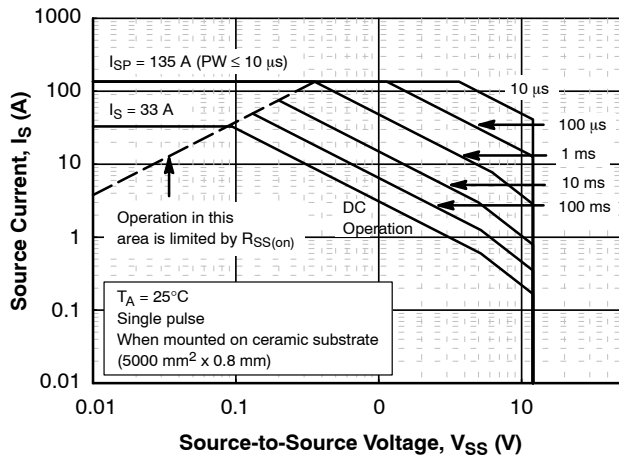


Figure 9. Safe Operating Area

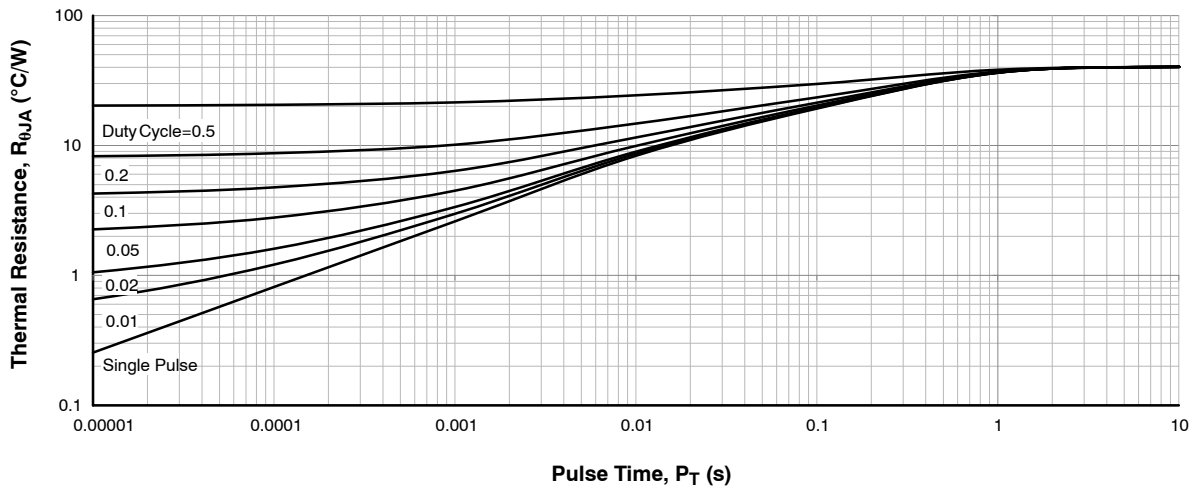
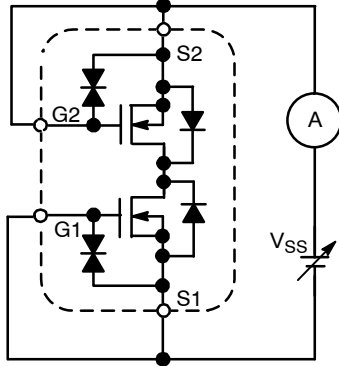


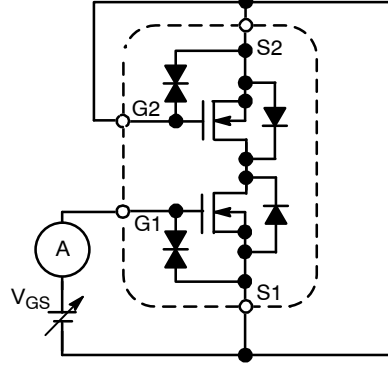
Figure 10. Thermal Response

Test Circuits are Example of Measuring FET1 Side

**Test Circuit 1**  
 $V_{(BR)SS} / I_{SSS}$

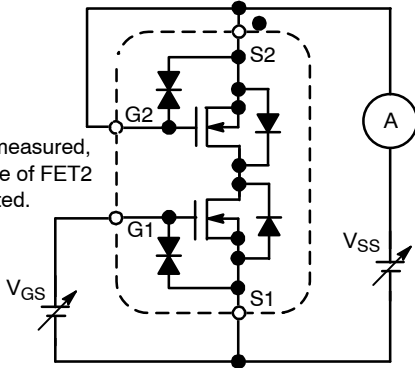


**Test Circuit 2**  
 $I_{GSS}$



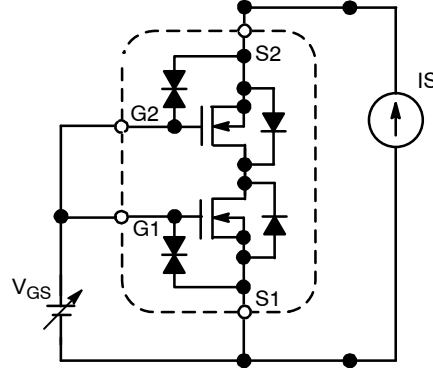
When FET1 is measured, Gate and Source of FET2 are short-circuited.

**Test Circuit 3**  
 $V_{GS(th)}$

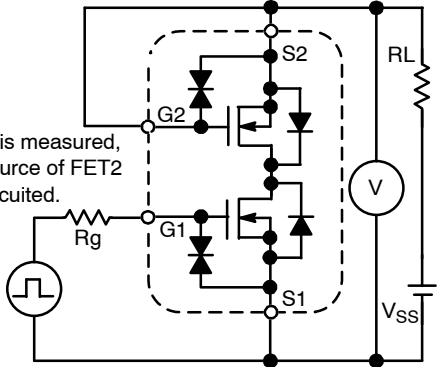


When FET1 is measured, Gate and Source of FET2 are short-circuited.

**Test Circuit 4**  
 $R_{SS(on)}$

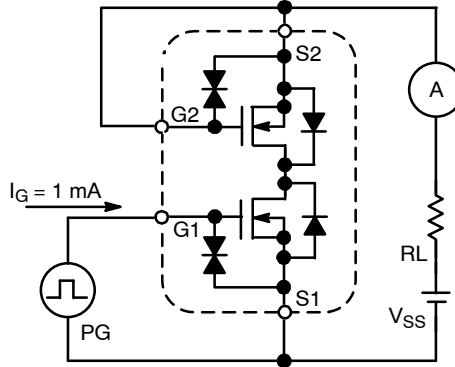


**Test Circuit 5**  
 $t_d(on), t_r, t_d(off), t_f$



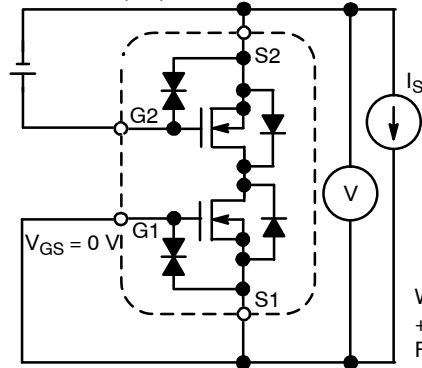
When FET1 is measured, Gate and Source of FET2 are short-circuited.

**Test Circuit 6**  
 $R_g$



When FET1 is measured, Gate and Source of FET2 are short-circuited.

**Test Circuit 7**  
 $V_{F(s-s)}$



When FET1 is measured, +4.5 V is added to  $V_{GS}$  of FET2.

# EFC2K102ANUZ

## ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing) <sup>†</sup>
EFC2K102ANUZTDG	PW	WLCSP10, 2.98x1.49x0.1 (Pb-Free/Halogen Free)	5,000 / Tape & Reel

<sup>†</sup>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.

NOTE: Since the EFC2K102ANUZ is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.

# MECHANICAL CASE OUTLINE

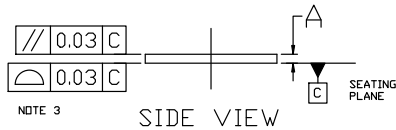
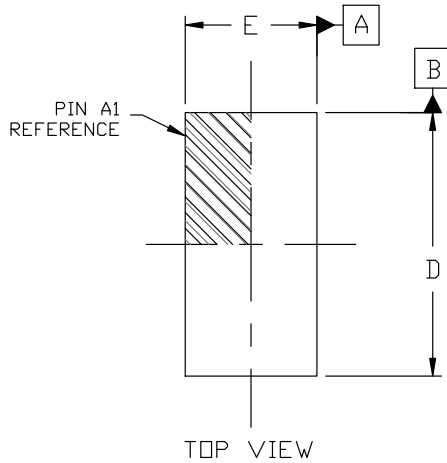
## PACKAGE DIMENSIONS

ON Semiconductor®



**WLCSP10 2.98x1.49x0.1**  
**CASE 567ZG**  
**ISSUE O**

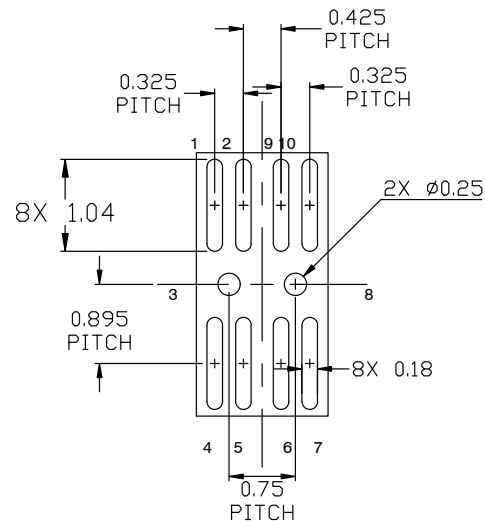
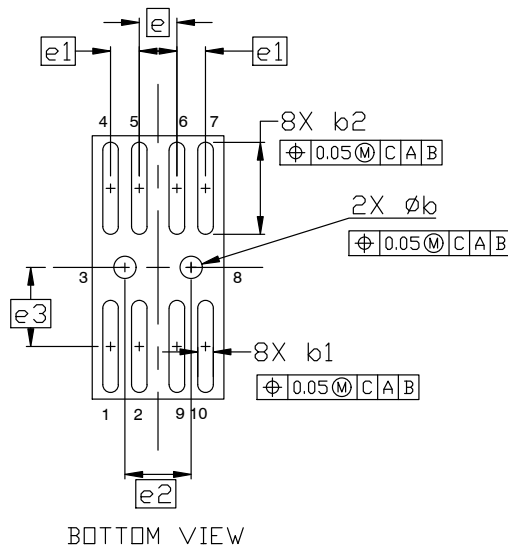
DATE 27 MAY 2020



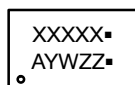
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO ALL PADS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.07	0.10	0.13
b	0.22	0.25	0.28
b1	0.145	0.175	0.205
b2	1.01	1.04	1.07
D	2.95	2.98	3.01
E	1.46	1.49	1.52
e	0.425 BSC		
e1	0.325 BSC		
e2	0.75 BSC		
e3	0.895 BSC		



**GENERIC MARKING DIAGRAM\***



XXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Assembly Lot Code  
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

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

\*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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<b>DESCRIPTION:</b>	<b>WLCSP10 2.98x1.49x0.1</b>	<b>PAGE 1 OF 1</b>

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