

MOSFET - Power for 1-Cell Lithium-ion Battery Protection

EFC2K103NUZ 12 V, 1.8 mΩ, 40 A, Dual N-Channel

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

Typical Applications

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

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS at $T_A = 25^\circ\text{C}$

Parameter	Symbol	Value	Unit
Source to Source Voltage	V_{SSS}	12	V
Gate to Source Voltage	V_{GSS}	± 8	V
Source Current (DC)	I_S	40	A
Source Current (Pulse) $PW \leq 10 \mu\text{s}$, Duty Cycle $\leq 1\%$	I_{SP}	140	A
Total Dissipation (Note 1)	P_T	3.3	W
Junction Temperature	T_J	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-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 RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 1)	$R_{\theta JA}$	37	$^\circ\text{C/W}$

1. Surface mounted on ceramic substrate ($5000 \text{ mm}^2 \times 0.8 \text{ mm}$)



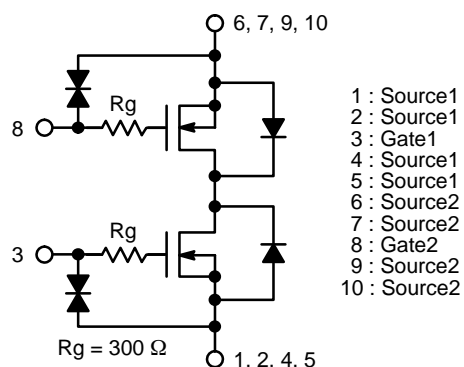
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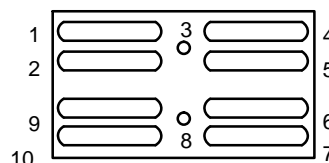
V_{SSS}	$R_{SS(ON)} \text{ MAX}$	$I_S \text{ MAX}$
12 V	1.8 mΩ @ 4.5 V	40 A
	1.9 mΩ @ 3.8 V	
	2.6 mΩ @ 3.1 V	
	4.2 mΩ @ 2.5 V	

ELECTRICAL CONNECTION

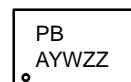
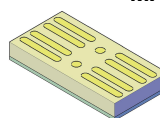
N-Channel



PIN ASSIGNMENT



MARKING DIAGRAM



WLCSP10
3.54x1.77x0.140
CASE 567XB

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

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 2 of this data sheet.

EFC2K103NUZ

ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$

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	μA
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = \pm 8 \text{ V}$, $V_{SS} = 0 \text{ V}$ Test Circuit 2	–	–	± 1	μA
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	0.8	1.25	1.8	$\text{m}\Omega$
		$I_S = 5 \text{ A}$, $V_{GS} = 3.8 \text{ V}$ Test Circuit 4	0.85	1.35	1.9	$\text{m}\Omega$
		$I_S = 5 \text{ A}$, $V_{GS} = 3.1 \text{ V}$ Test Circuit 4	1.0	1.7	2.6	$\text{m}\Omega$
		$I_S = 5 \text{ A}$, $V_{GS} = 2.5 \text{ V}$ Test Circuit 4	1.2	2.1	4.2	$\text{m}\Omega$
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	–	25	–	μs
Rise Time	t_r		–	100	–	μs
Turn-OFF Delay Time	$t_d(off)$		–	165	–	μs
Fall Time	t_f		–	148	–	μs
Total Gate Charge	Q_g	$V_{SS} = 6 \text{ V}$, $V_{GS} = 3.8 \text{ V}$, $I_S = 5 \text{ A}$ Test Circuit 6	–	62	–	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	1.2	V

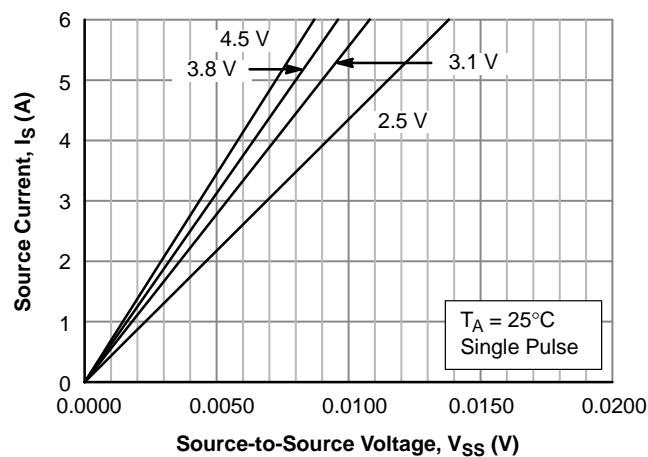
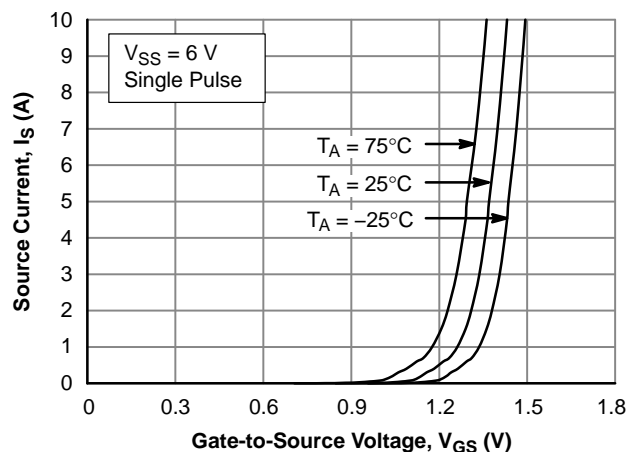
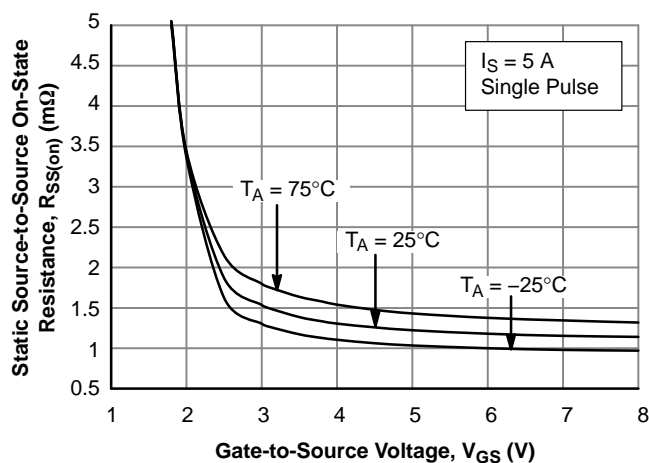
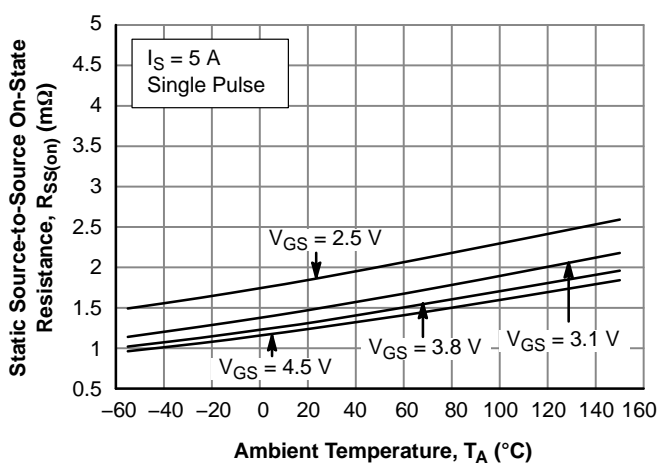
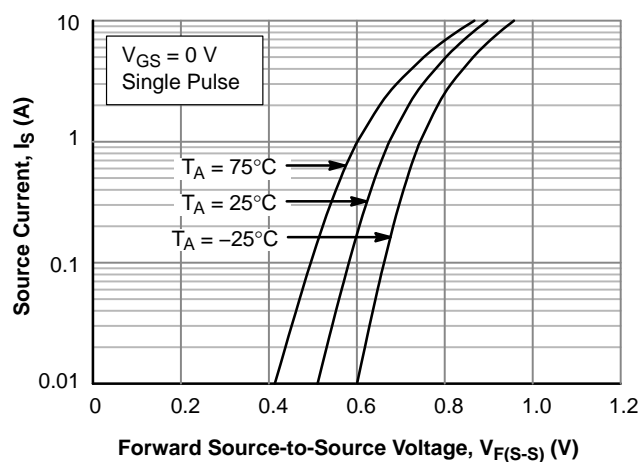
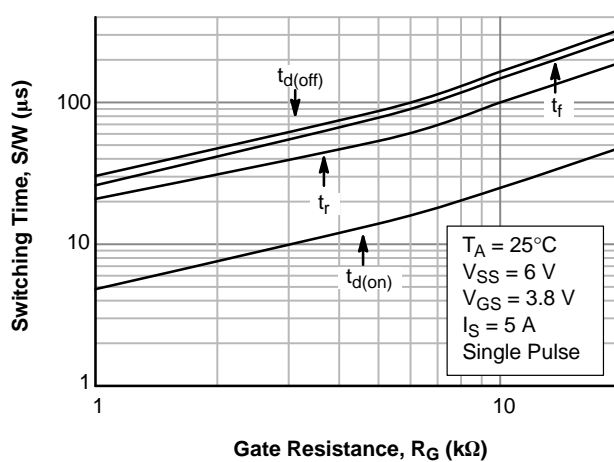
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing) [†]
EFC2K103NUZTDG	PB	WLCSP10, $3.54 \times 1.77 \times 0.140$ (Pb-Free / Halogen Free)	5,000 / 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.

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

TYPICAL CHARACTERISTICS (Continued)

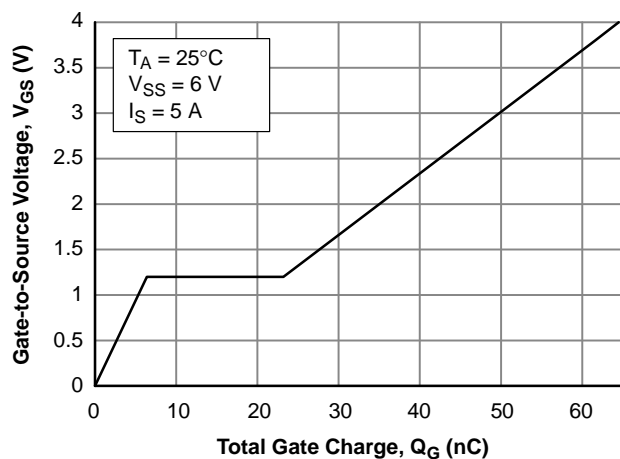


Figure 7. $V_{GS} - Q_G$

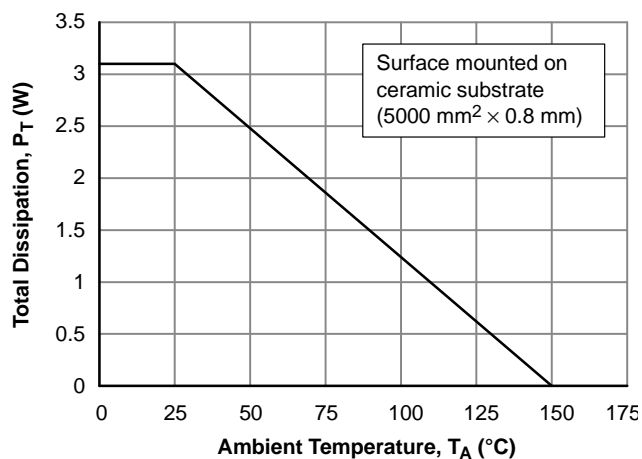


Figure 8. $P_T - T_A$

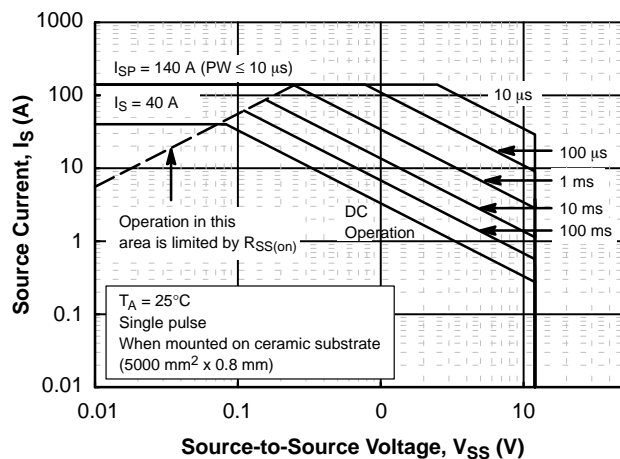


Figure 9. Safe Operating Area

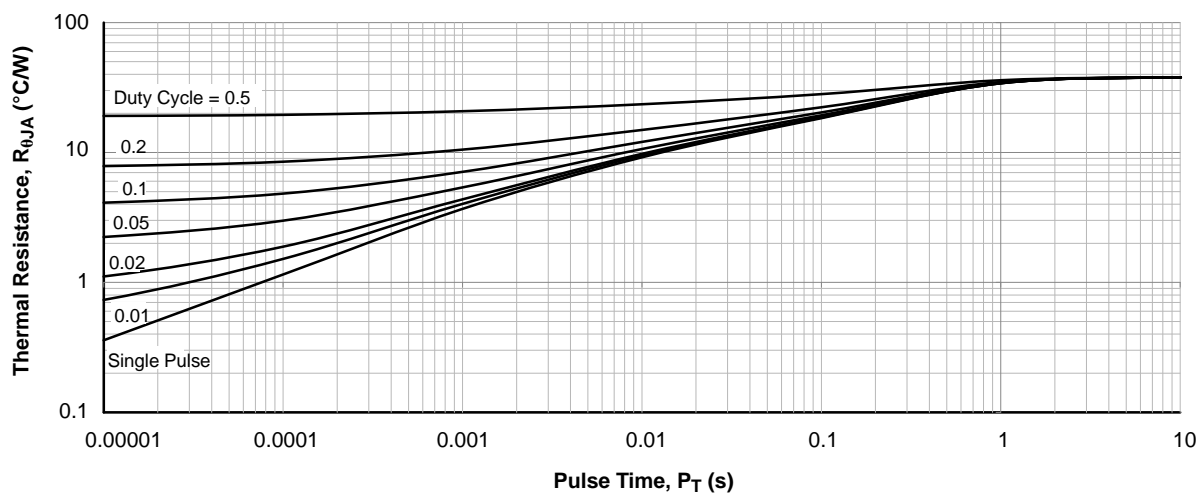


Figure 10. Thermal Response

TEST CIRCUITS ARE EXAMPLES OF MEASURING FET1 SIDE

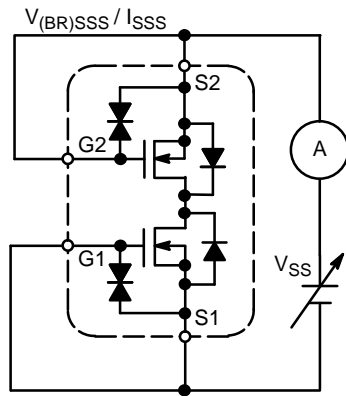


Figure 11. Test Circuit
1

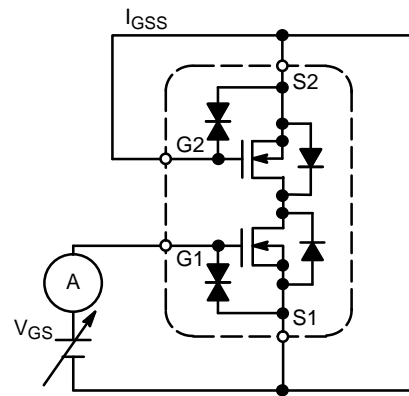
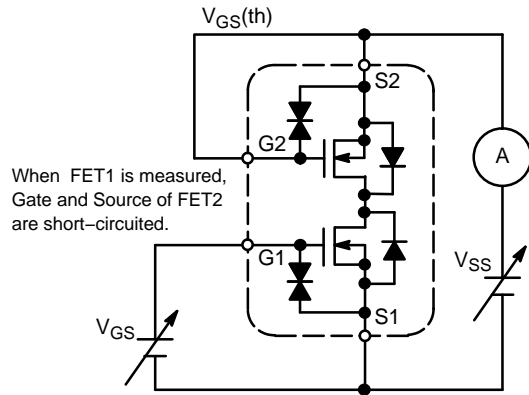


Figure 12. Test Circuit
2

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



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

Figure 13. Test Circuit
3

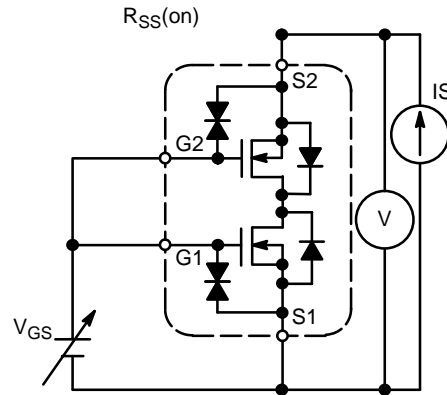
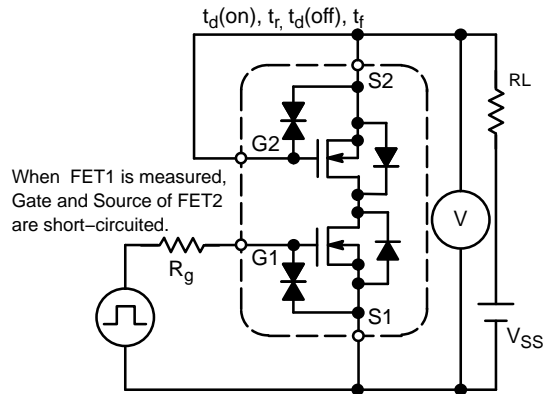
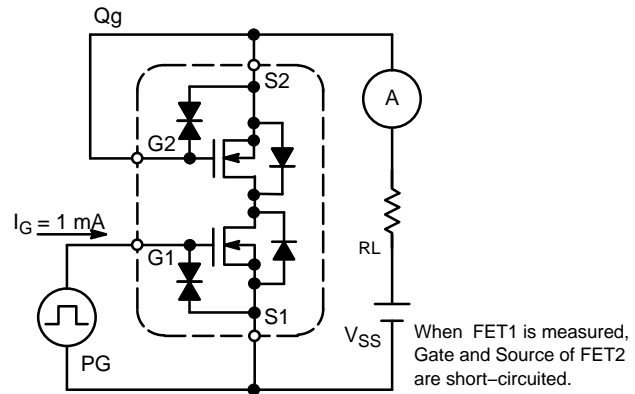


Figure 14. Test Circuit
4



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

Figure 15. Test Circuit
5



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

Figure 16. Test Circuit
6

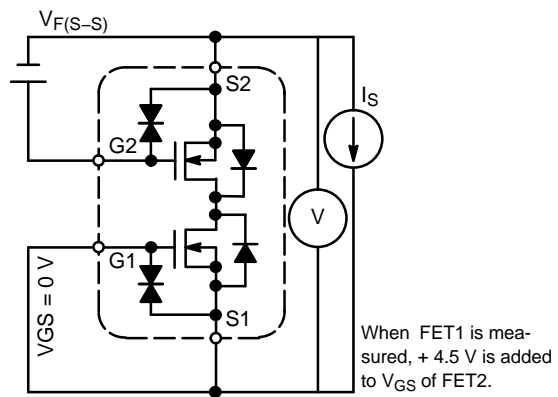
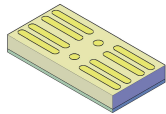


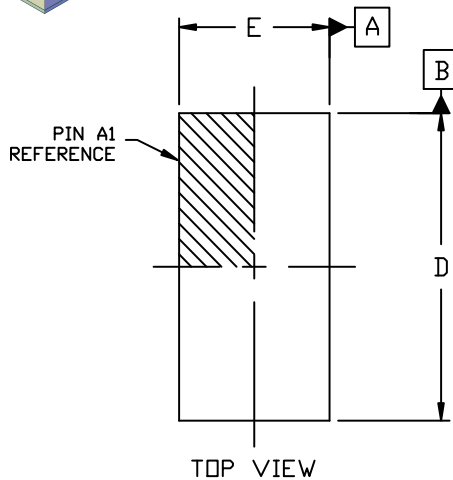
Figure 17. Test Circuit
7

NOTE: When FET2 is measured, the position of FET1 and FET2 is switched.

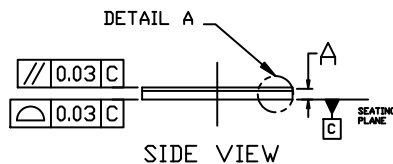
NOTE: Since the EFC2K103NUZ is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.


WLCSP10, 3.54x1.77x0.14
CASE 567XB
ISSUE O

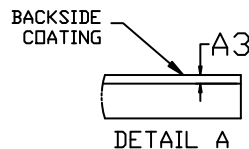
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TOP VIEW



SIDE VIEW

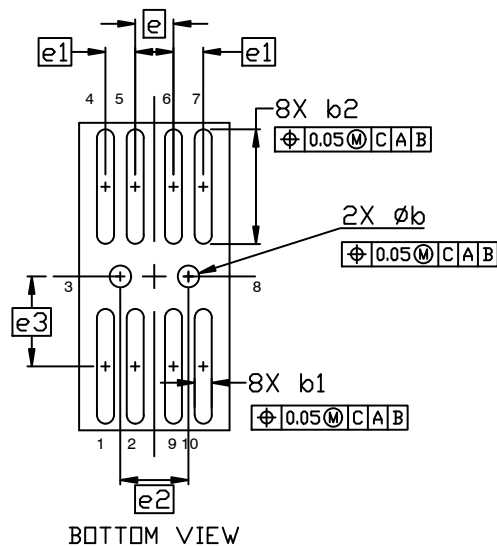


DETAIL A

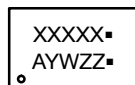
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.11	0.14	0.17
A3	0.04 REF		
b	0.22	0.25	0.28
b1	0.17	0.20	0.23
b2	1.29	1.32	1.35
D	3.51	3.54	3.57
E	1.74	1.77	1.80
e	0.45 BSC		
e1	0.35 BSC		
e2	0.80 BSC		
e3	1.035 BSC		

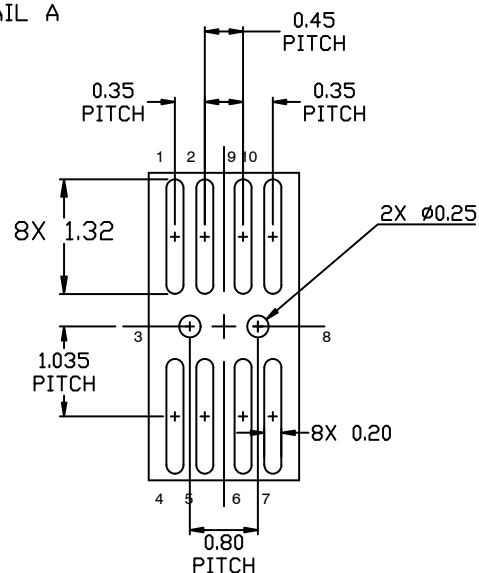


BOTTOM VIEW

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)



RECOMMENDED MOUNTING FOOTPRINT

*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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