

FDMC6696P Datasheet

 onsemi

| | |
|------------------------------|----------------------------------|
| DiGi Electronics Part Number | FDMC6696P-DG |
| Manufacturer | onsemi |
| Manufacturer Product Number | FDMC6696P |
| Description | FDMC6696 - P-CHANNEL POWERTRENCH |
| Detailed Description | |

<https://www.DiGi-Electronics.com>



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DiGi is a global authorized distributor of electronic components.

Purchase and inquiry

Manufacturer Product Number:

FDMC6696P

Series:

*

Manufacturer:

onsemi

Product Status:

Active

Environmental & Export classification

Moisture Sensitivity Level (MSL):

Vendor Undefined

REACH Status:

REACH Unaffected

MOSFET – P-Channel, POWERTRENCH®

-20 V, -75 A, 4.9 mΩ

FDMC6696P

General Description

This P-Channel MOSFET is produced using onsemi's advanced POWERTRENCH process that has been optimized for $R_{DS(on)}$, switching performance and ruggedness.

Features

- Max $R_{DS(on)}$ = 4.9 mΩ at $V_{GS} = -4.5$ V, $I_D = -18$ A
- Max $R_{DS(on)}$ = 16.4 mΩ at $V_{GS} = -1.8$ V, $I_D = -9$ A
- High Performance Trench Technology for Extremely Low $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

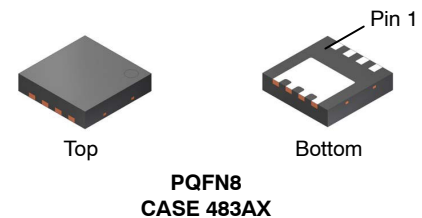
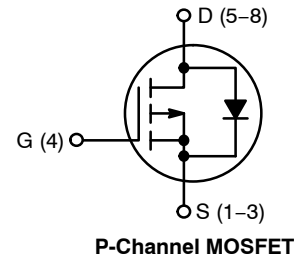
- Load Switch
- Battery Management
- Power Management
- Reverse Polarity Protection

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

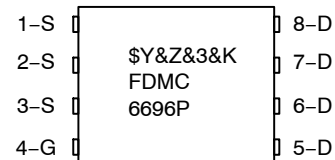
| Symbol | Parameter | Value | Unit |
|----------------|--|---------------------------|------|
| V_{DS} | Drain to Source Voltage | -20 | V |
| V_{GS} | Gate to Source Voltage | ±12 | V |
| I_D | Drain Current: Continuous, $T_C = 25^\circ\text{C}$ (Note 5) Continuous, $T_C = 100^\circ\text{C}$ (Note 5) Continuous, $T_A = 25^\circ\text{C}$ (Note 1a) Pulsed (Note 4) | -75 -47 -18 -335 | A |
| E_{AS} | Single Pulse Avalanche Energy (Note 3) | 54 | mJ |
| P_D | Power Dissipation: $T_C = 25^\circ\text{C}$ $T_A = 25^\circ\text{C}$ (Note 1a) | 40 2.4 | W |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -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.

| V_{DS} | $R_{DS(ON)}$ MAX | I_D MAX |
|----------|------------------|-----------|
| -20 V | 4.9 mΩ @ -4.5 V | -75 A |
| | 6.5 mΩ @ -2.5 V | |
| | 16.4 mΩ @ -1.8 V | |



MARKING DIAGRAM



\$Y = onsemi Logo
&Z = Assembly Plant Code
&3 = Data Code (Year & Week)
&K = Lot
FDMC6696P = Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

FDMC6696P

Thermal Characteristics

| Symbol | Parameter | FDMC6696P | Unit |
|-----------------|---|-----------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 3.1 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 53 | |

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|--------|-----------|-----------------|------|------|------|-------|
|--------|-----------|-----------------|------|------|------|-------|

OFF CHARACTERISTICS

| | | | | | | |
|------------------------------|---|---|-----|-----|-----------|---------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = -250 \mu\text{A}$, $V_{GS} = 0 \text{ V}$ | -20 | | | V |
| $\Delta BV_{DSS}/\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = -250 \mu\text{A}$, Referenced to 25°C | | -15 | | mV/°C |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -16 \text{ V}$, $V_{GS} = 0 \text{ V}$ | | | -1 | μA |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 12 \text{ V}$, $V_{DS} = 0 \text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS

| | | | | | | |
|--------------------------------|--|--|------|------|------|------------|
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = -250 \mu\text{A}$ | -0.4 | -0.7 | -1.6 | V |
| $\Delta V_{GS(th)}/\Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = -250 \mu\text{A}$, referenced to 25°C | | 4 | | mV/°C |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = -4.5 \text{ V}$, $I_D = -18 \text{ A}$ | | 3.3 | 4.9 | m Ω |
| | | $V_{GS} = -2.5 \text{ V}$, $I_D = -11 \text{ A}$ | | 4.1 | 6.5 | |
| | | $V_{GS} = -1.8 \text{ V}$, $I_D = -9 \text{ A}$ | | 6.2 | 16.4 | |
| | | $V_{GS} = -4.5 \text{ V}$, $I_D = -18 \text{ A}$, $T_J = 125^\circ\text{C}$ | | 4.5 | 6.8 | |
| g_{FS} | Forward Transconductance | $V_{DS} = -5 \text{ V}$, $I_D = -18 \text{ A}$ | | 113 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|-----------|------------------------------|--|-----|------|-------|----------|
| C_{iss} | Input Capacitance | $V_{DS} = -10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$ | | 7535 | 10550 | pF |
| C_{oss} | Output Capacitance | | | 1100 | 1540 | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 1040 | 1455 | pF |
| R_g | Gate Resistance | | 0.1 | 4.5 | 10 | Ω |

SWITCHING CHARACTERISTICS

| | | | | | | |
|--------------|-------------------------------|--|--|-----|-----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -10 \text{ V}$, $I_D = -18 \text{ A}$, $V_{GS} = -4.5 \text{ V}$, $R_G = 6 \Omega$ | | 13 | 23 | ns |
| t_r | Rise Time | | | 17 | 31 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 312 | 499 | ns |
| t_f | Fall Time | | | 176 | 282 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge | $V_{GS} = 0 \text{ V}$ to -4.5 V , $V_{DD} = -10 \text{ V}$, $I_D = -18 \text{ A}$ | | 78 | 109 | nC |
| | | $V_{GS} = 0 \text{ V}$ to -2.5 V , $V_{DD} = -10 \text{ V}$, $I_D = -18 \text{ A}$ | | 50 | 70 | nC |
| Q_{gs} | Gate to Source Charge | $V_{DD} = -10 \text{ V}$, $I_D = -18 \text{ A}$ | | 12 | | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | $V_{DD} = -10 \text{ V}$, $I_D = -18 \text{ A}$ | | 24 | | nC |

DRAIN-SOURCE DIODE CHARACTERISTICS

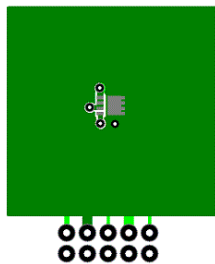
| | | | | | | |
|----------|---------------------------------------|---|--|------|------|----|
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0 \text{ V}$, $I_S = -18 \text{ A}$ (Note 2) | | -0.7 | -1.2 | V |
| | | $V_{GS} = 0 \text{ V}$, $I_S = -2 \text{ A}$ (Note 2) | | -0.6 | -1.2 | |
| t_{rr} | Reverse Recovery Time | $I_S = -18 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ | | 41 | 66 | ns |
| Q_{rr} | Reverse Recovery Charge | | | 22 | 35 | 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.

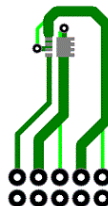
FDMC6696P

NOTES:

1. $R_{\theta JA}$ 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) 53 °C/W when mounted on a 1 in² pad of 2 oz copper.



b) 125 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0 %
3. E_{AS} of 54 mJ is based on starting $T_J = 25$ C, $L = 3$ mH, $I_{AS} = -6$ A, $V_{DD} = -20$ V, $V_{GS} = -10$ V.
4. Pulsed I_d please refer to Fig 11 SOA graph for more details.
5. Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

PACKAGE MARKING AND ORDERING INFORMATION

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|-----------------|-----------|------------|------------|
| FDMC6696P | FDMC6696P | PQFN8 (Pb Free) | 13" | 12 mm | 3000 Units |

FDMC6696P

TYPICAL CHARACTERISTICS

($T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)

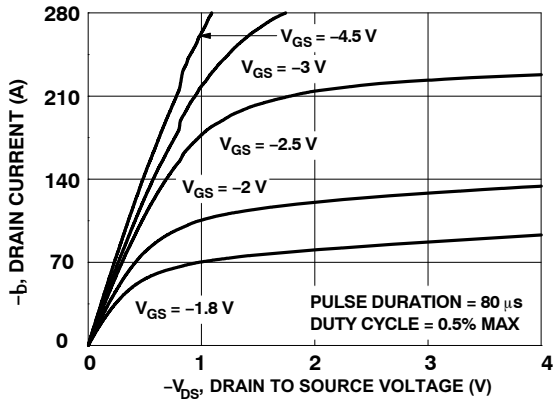


Figure 1. On-Region Characteristics

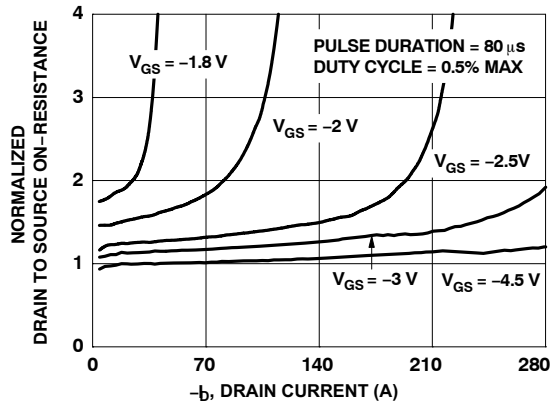


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

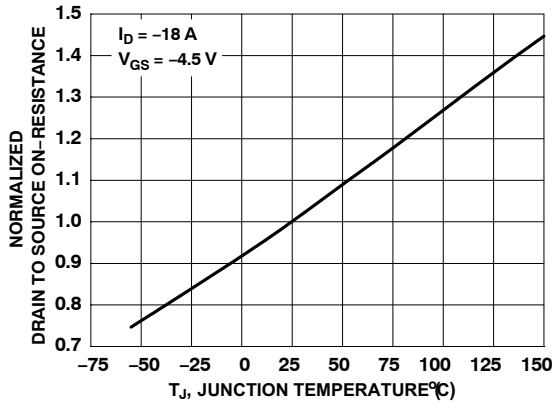


Figure 3. Normalized On-Resistance vs Junction Temperature

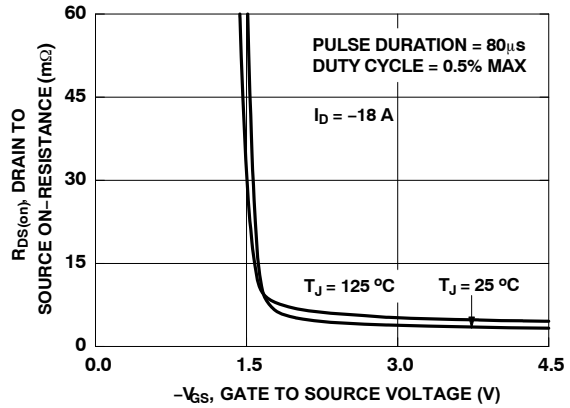


Figure 4. On-Resistance vs Gate to Source Voltage

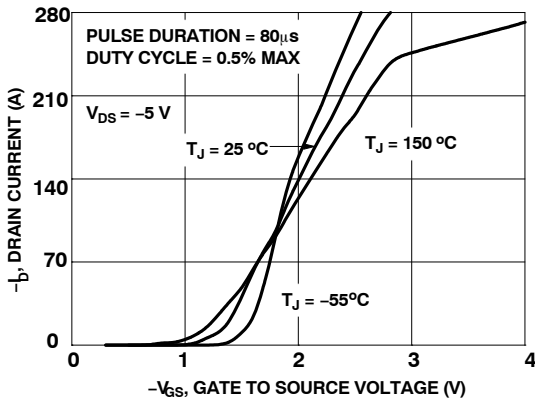


Figure 5. Transfer Characteristics

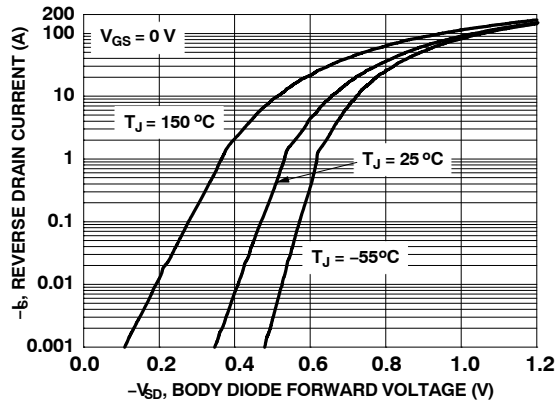


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

FDMC6696P

TYPICAL CHARACTERISTICS

($T_J = 25^\circ\text{C}$ unless otherwise noted)

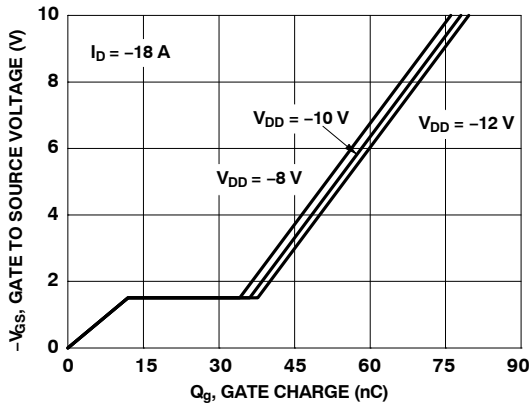


Figure 7. Gate Charge Characteristics

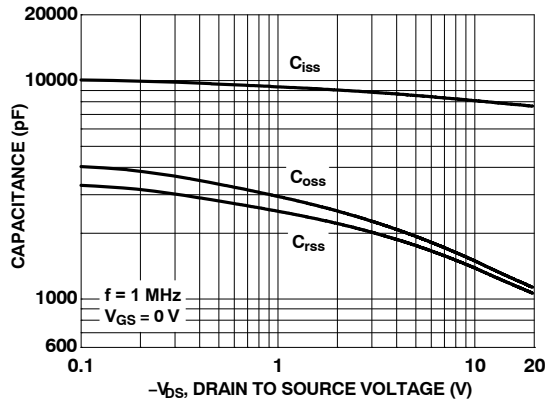


Figure 8. Capacitance vs Drain to Source Voltage

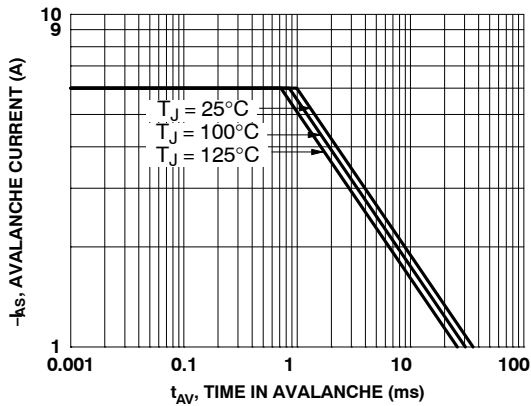


Figure 9. Unclamped Inductive Switching Capability

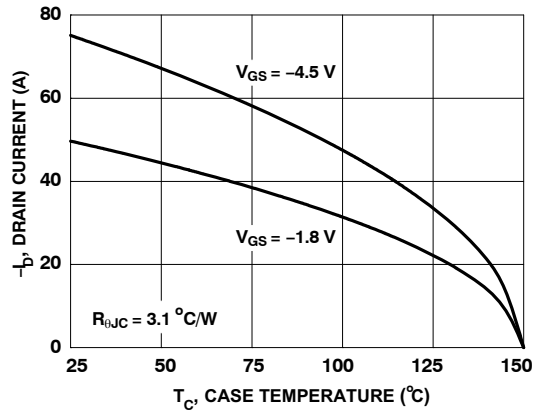


Figure 10. Maximum Continuous Drain Current vs Case Temperature

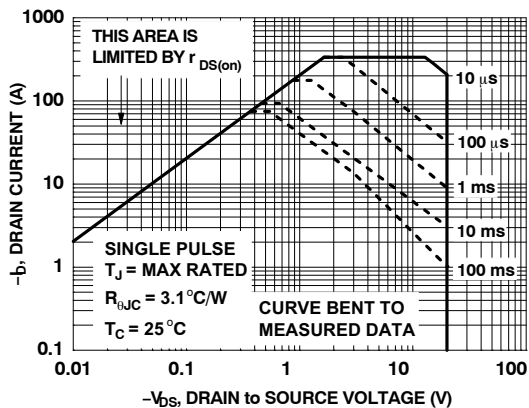


Figure 11. Forward Bias Safe Operating Area

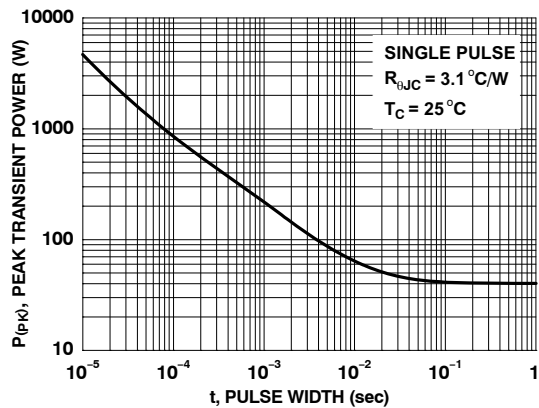


Figure 12. Single Pulse Maximum Power Dissipation

FDMC6696P

TYPICAL CHARACTERISTICS

($T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted)

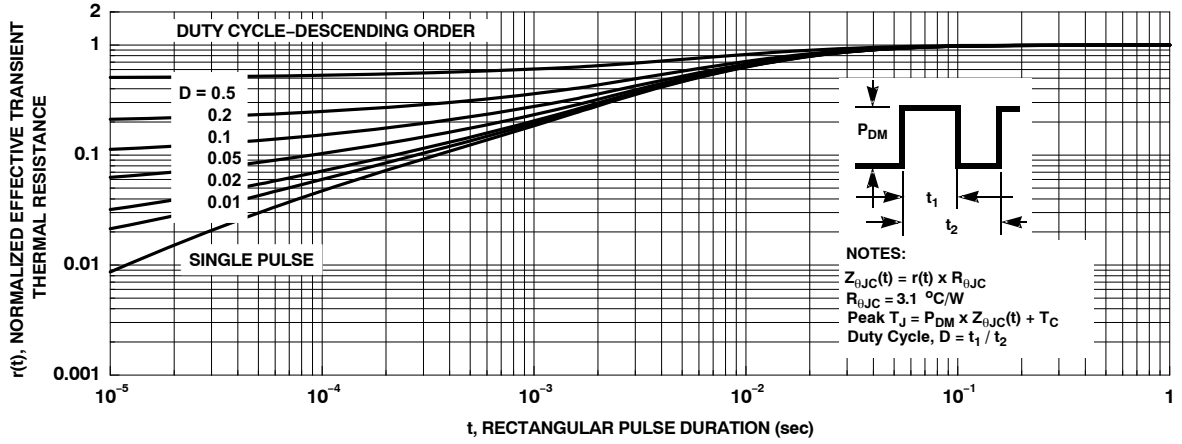
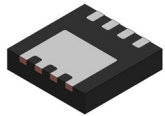


Figure 13. Junction-to-Case Transient Thermal Response Curve

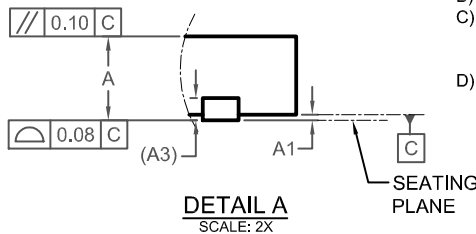
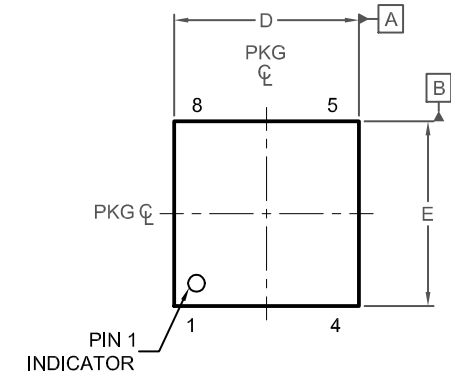


**MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS**



**PQFN8 3.3X3.3, 0.65P
CASE 483AX
ISSUE B**

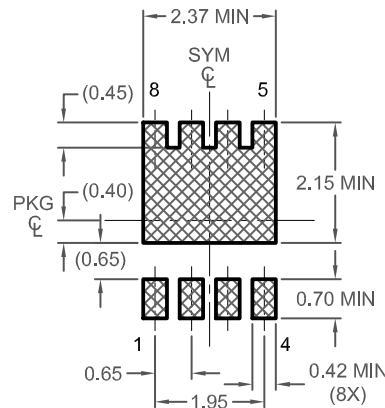
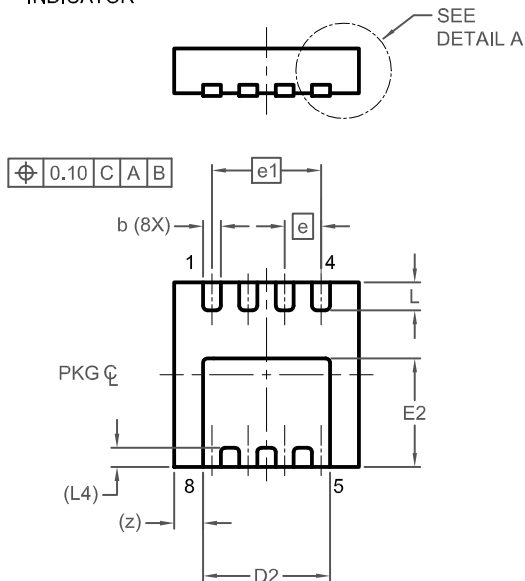
DATE 24 JUN 2022



NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.27 | 0.32 | 0.37 |
| D | 3.20 | 3.30 | 3.40 |
| D2 | 2.17 | 2.27 | 2.37 |
| E | 3.20 | 3.30 | 3.40 |
| E2 | 1.84 | 1.94 | 2.04 |
| e | 0.65 BSC | | |
| e1 | 1.95 BSC | | |
| L | 0.40 | 0.50 | 0.60 |
| L4 | 0.34 REF | | |
| z | 0.52 REF | | |



**LAND PATTERN
RECOMMENDATION**

*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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