



FDMQ8205

GreenBridge™ 2 Series of High-Efficiency Bridge Rectifiers

Features

- Low Power Loss GreenBridge™ Replaces Diode Bridge
- Self Driving Circuitry for MOSFETs
- Low $r_{DS(on)}$ 80V Rated MOSFETs
- Maximizing Available Power and Voltage
- Eliminating Thermal Design Problems
- IEEE802.3at Compatible
 - Meet Detection and Classification Requirement
 - Work with 2 and 4-pair Architecture
 - Small Backfeed Voltage
- Compact MLP 4.5x5 Package

Applications

- Power over Ethernet (PoE) Power Device (PD)
 - IP Phones
 - Network Cameras
 - Wireless Access Points
 - Thin Clients
 - Microcell
 - Femtocell

General Description

FDMQ8205 is GreenBridge™2 series of quad MOSFETs for a bridge application so that the input will be insensitive to the polarity of a power source coupled to the device. Many known bridge rectifier circuits can be configured using typical diodes. The conventional diode bridge has relatively high power loss that is undesirable in many applications. Especially, Power over Ethernet (PoE) Power Device (PD) application requires high-efficiency bridges because it should be operated with the limited power delivered from Power Source Equipment (PSE) which is classified by IEEE802.3at. FDMQ8205 is configured with low $r_{DS(on)}$ dual P-ch MOSFETs and N-ch MOSFETs so that it can reduce the power loss caused by the voltage drop, compared to the conventional diode bridge. FDMQ8205 enables the application to maximize the available power and voltage and to eliminate the thermal design problems in PoE PD applications.

FDMQ8205 GreenBridge™2 is compatible with IEEE802.3at PoE standard by not compromising detection and classification requirement as well as small backfeed voltage.

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMQ8205	FDMQ8205	MLP4.5x5	13 "	12 mm	3000 units

Typical Application

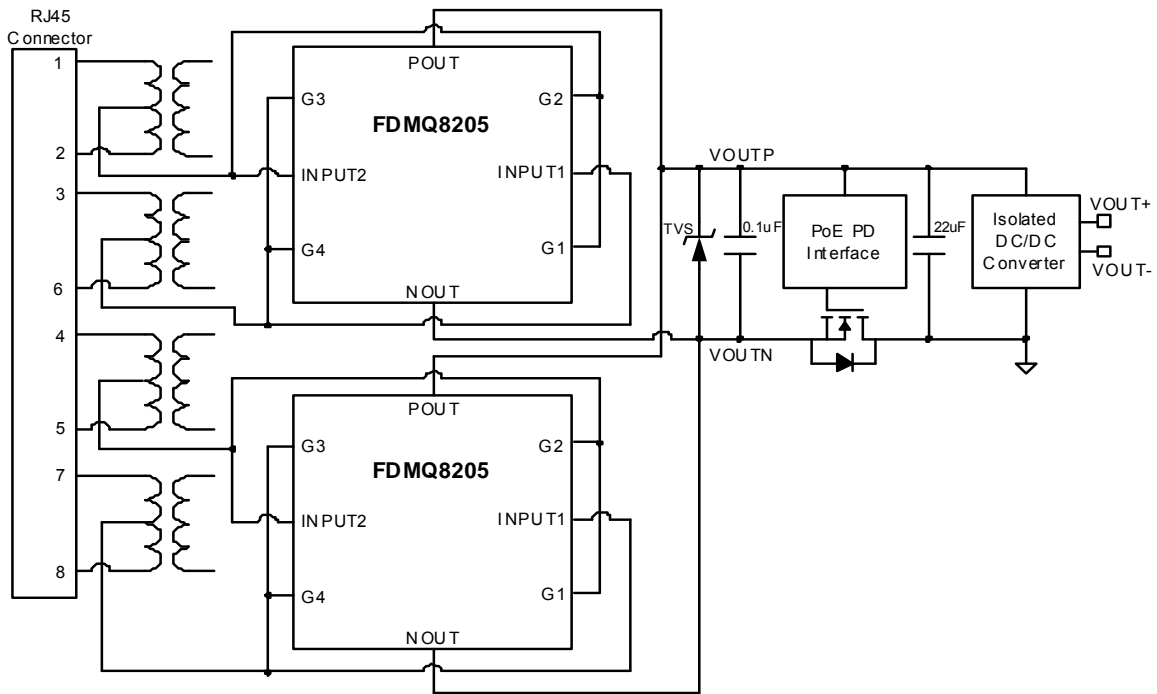


Figure 1. Typical Application of Power Device for Power over Ethernet

Block Diagram

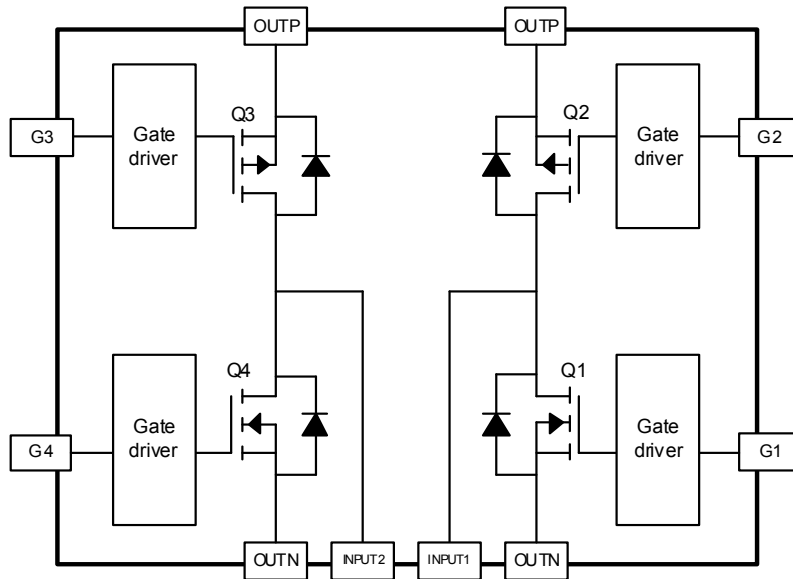
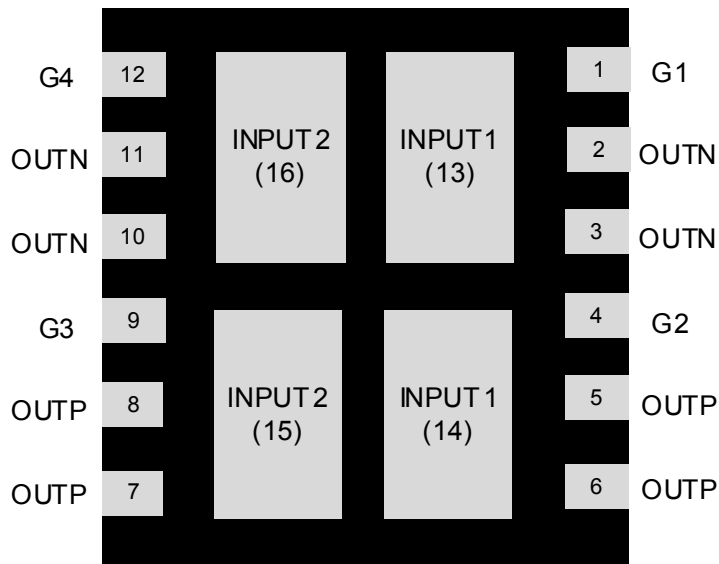


Figure 2. Block Diagram

Pin Configuration



MLP 4.5x5

Figure 3. Pin Assignment (Bottom View)

Pin Descriptions

Pin Number	Name	Description
1	G1	Gate of Q1 N-ch MOSFET
4	G2	Gate of Q2 P-ch MOSFET
9	G3	Gate of Q3 P-ch MOSFET
12	G4	Gate of Q4 N-ch MOSFET
13,14	INPUT1	Input1 of GreenBridge™
15,16	INPUT2	Input2 of GreenBridge™
2,3,11,10	OUTN	Negative Output of GreenBridge™
5,6,7,8	OUTP	Positive Output of GreenBridge™

Notes:

1. Show the feature that provides orientation or pin 1 location.

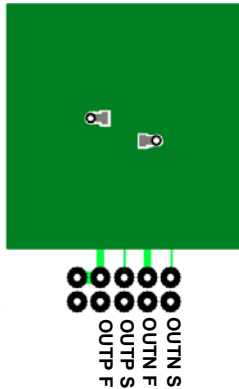
Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

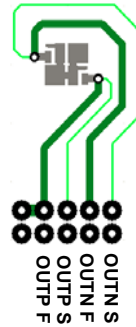
		Min.	Max.	Units
	INPUT1, INPUT2 to OUTN		80	V
	OUTP to INPUT1, INPUT2		80	V
	INPUT1 to INPUT2		80	V
	INPUT2 to INPUT1		80	V
	OUTP to OUTN		80	V
	G1, G2, G3, G4 to OUTN		70	V
	OUTP to G1, G2, G3, G4		70	V
$V_{G_TRANSIENT}$	Transient Gate Voltage, Pulse Width < 200 μ s, Duty Cycle < 0.003%		100	V
Continuous I_{INPUT} (GreenBridge™ Current, Q1+Q3 or Q2+Q4)	$T_A = 25\text{ }^\circ\text{C}$ (Note 2a)		3.0	A
	$T_A = 25\text{ }^\circ\text{C}$ (Note 2b)		1.7	A
Pulsed I_{INPUT} (Q1+Q3 or Q2+Q4)	Pulse Width < 300 μ s, Duty Cycle < 2% (Note 3)		58	A
P_D (Power Dissipation, Q1+Q3 or Q2+Q4)	$T_A = 25\text{ }^\circ\text{C}$ (Note 2a)		2.5	W
	$T_A = 25\text{ }^\circ\text{C}$ (Note 2b)		0.78	W
Max Junction Temperature			150	$^\circ\text{C}$

Notes :

2. $R_{\theta JA}$ 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. 50 $^\circ\text{C/W}$ when mounted on a 1 in² pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.



b. 160 $^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper, the board designed Q1+Q3 or Q2+Q4.

3. Pulse Id measured at $t_d \leq 300\mu\text{s}$, refer to SOA graph for more details.

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case		5.1		$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 2a)		50		
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 2b)		160		

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Units
V_{INPUT}	Input Voltage of Bridge	INPUT1 to INPUT2 or INPUT2 to INPUT1		57	V
V_G	Gate Voltage of MOSFETs	G1, G4 to OUTN G2, G3 to OUTP		57	V
I_{INPUT}	Input Current of Bridge	Bridge Current through Q2 and Q4 or (Q3 and Q1)		1.7	A
Ambient Operation Temperature (T_A)			-40	85	°C
Junction Operating Temperature (T_J) (Note 5)			-40	125	°C

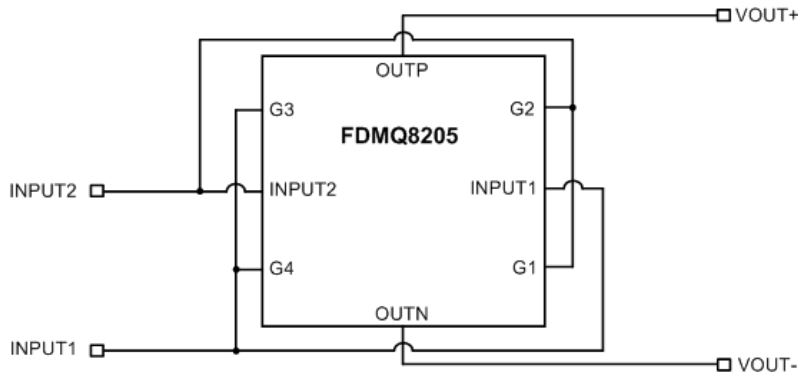
Electrical Characteristics

Unless otherwise noted: $T_J = 25\text{ °C}$ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{INPUT}	Input Voltage of Bridge	At INPUT1 to INPUT2 or INPUT2 to INPUT1			57	V
V_G	Gate Voltage of MOSFETs	At G1, G4 to OUTN and G2, G3 to OUTP			57	V
I_Q	Quiescent Current	Detection Mode $1.5\text{ V} < V_{INPUT} = V_G < 10.1\text{ V}$ (Note 4)			5	μA
		Classification Mode $10.2\text{ V} < V_{INPUT} = V_G < 23.9\text{ V}$ (Note 4)			400	μA
		Power On Mode Maximum $V_{INPUT} = V_G = 57\text{ V}$ (Note 4)			3.2	mA
V_{TURN_ON}	Turn-On Voltage of MOSFETs	Turn-On of MOSFETs while V_G Increases (Note 4)	32		36	V
$I_{LEAKAGE}$	Turn-Off Leakage Current	$V_{OUTP} = 57\text{ V}$, $V_{OUTN} = 0\text{ V}$ $T_J = -40\text{ °C}$ to 85 °C (Note 4)			700	μA
V_{BF}	Backfeed Voltage	$V_{OUTP} = 57\text{ V}$, $V_{OUTN} = 0\text{ V}$, 100 kOhm between INPUT1 and INPUT2 $T_J = -40\text{ °C}$ to 85 °C (Note 4)			2.7	V
$r_{DS(on)}$	N-ch MOSFET	$V_G = 42\text{ V}$, $I_{INPUT} = 1.5\text{ A}$, $T_A = 25\text{ °C}$		35	51	$\text{m}\Omega$
		$V_G = 48\text{ V}$, $I_{INPUT} = 1.5\text{ A}$, $T_A = 25\text{ °C}$		29	44	$\text{m}\Omega$
		$V_G = 57\text{ V}$, $I_{INPUT} = 1.5\text{ A}$, $T_A = 25\text{ °C}$		26	37	$\text{m}\Omega$
	P-ch MOSFET	$V_G = -42\text{ V}$, $I_{INPUT} = -1.5\text{ A}$, $T_A = 25\text{ °C}$		95	147	$\text{m}\Omega$
		$V_G = -48\text{ V}$, $I_{INPUT} = -1.5\text{ A}$, $T_A = 25\text{ °C}$		83	125	$\text{m}\Omega$
		$V_G = -57\text{ V}$, $I_{INPUT} = -1.5\text{ A}$, $T_A = 25\text{ °C}$		76	107	$\text{m}\Omega$

Notes:

4. INPUT1 is connected to G3 and G4 and also INPUT2 is connected to G1 and G2 like below.



5. Backfeed Voltage can not be guaranteed for junction temperature in excess of 85 °C . See V_{BF} in Electrical Characteristics Table.

Typical Characteristics (Q1 or Q4 N-Channel) $T_J = 25^\circ\text{C}$ unless otherwise noted.

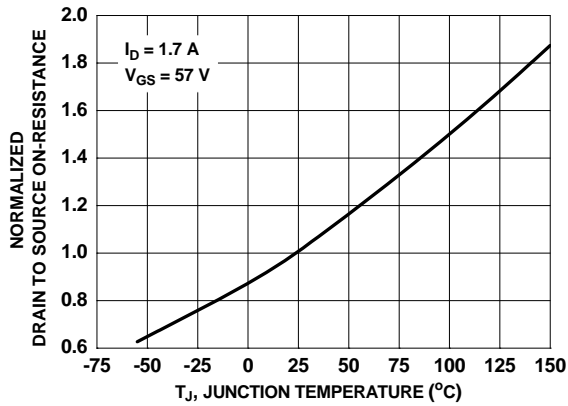


Figure 4. Normalized On Resistance vs. Junction Temperature

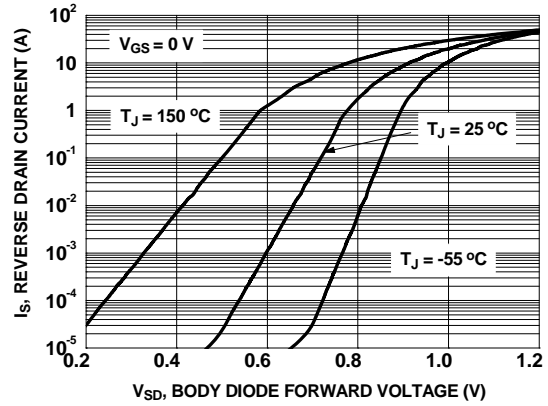


Figure 5. Source to Drain Diode Forward Voltage vs. Source Current

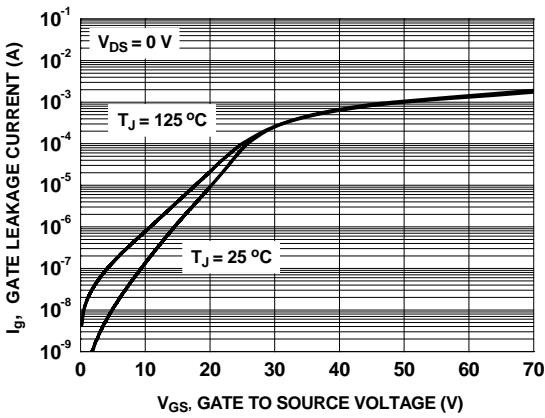


Figure 6. Gate Leakage Current vs. Gate to Source Voltage

Typical Characteristics (Q2 or Q3 P-Channel) $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

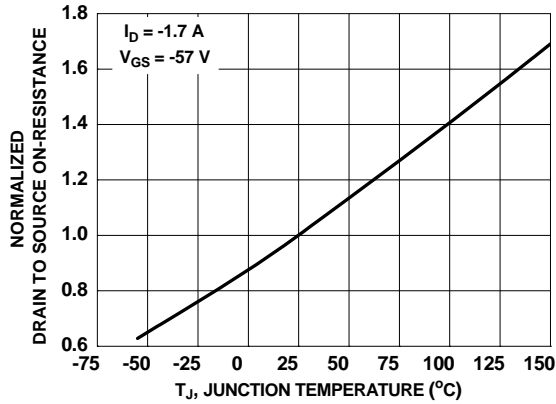


Figure 7. Normalized On Resistance vs. Junction Temperature

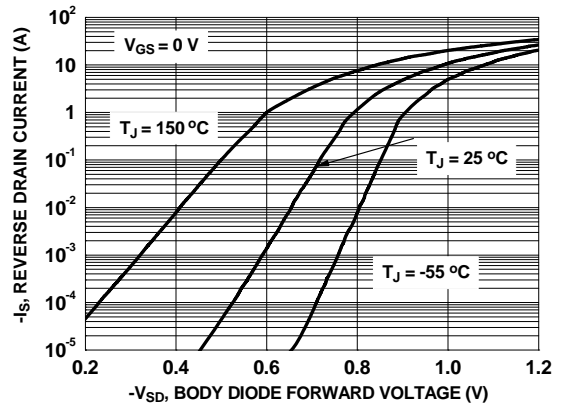


Figure 8. Source to Drain Diode Forward Voltage vs. Source Current

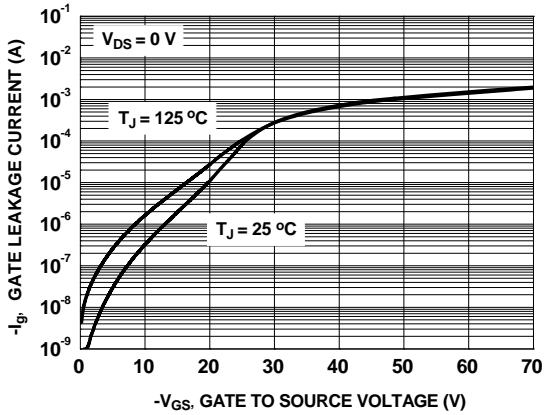


Figure 9. Gate Leakage Current vs. Gate to Source Voltage

Typical Characteristics (Q1 + Q3 or Q2 + Q4 In Serial) $T_J = 25^\circ\text{C}$ unless otherwise noted.

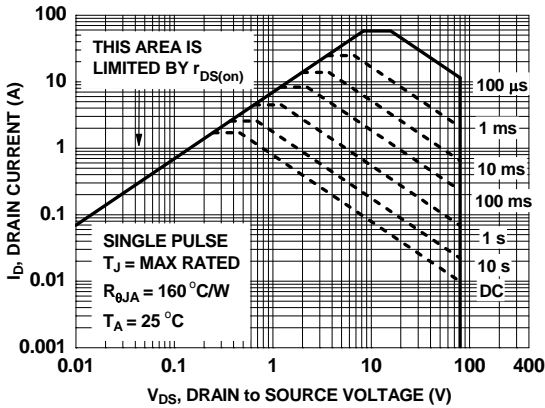


Figure 10. Forward Bias Safe Operating Area

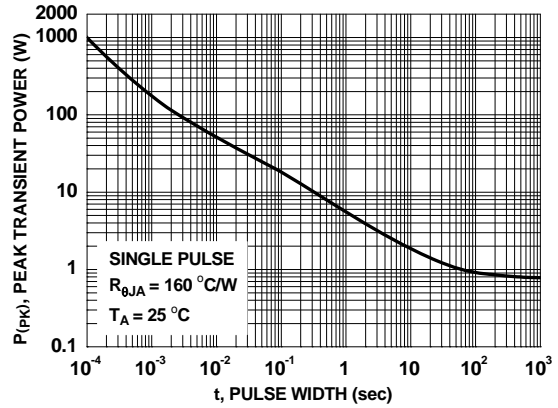


Figure 11. Single Pulse Maximum Power Dissipation

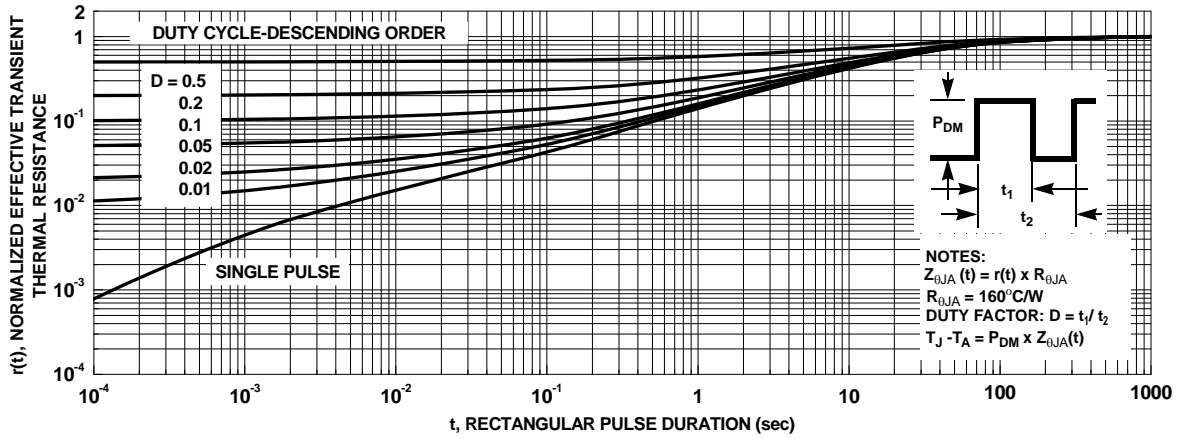


Figure 12. Junction-to-Ambient Transient Thermal Response Curve

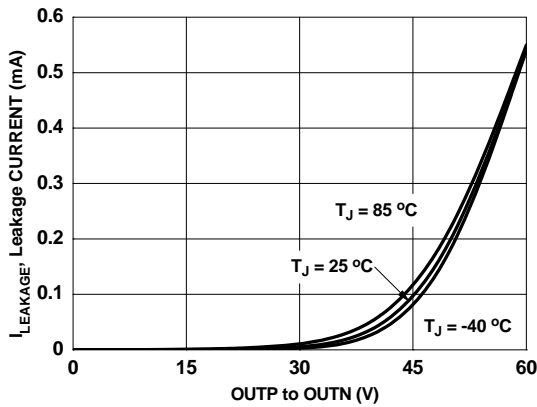
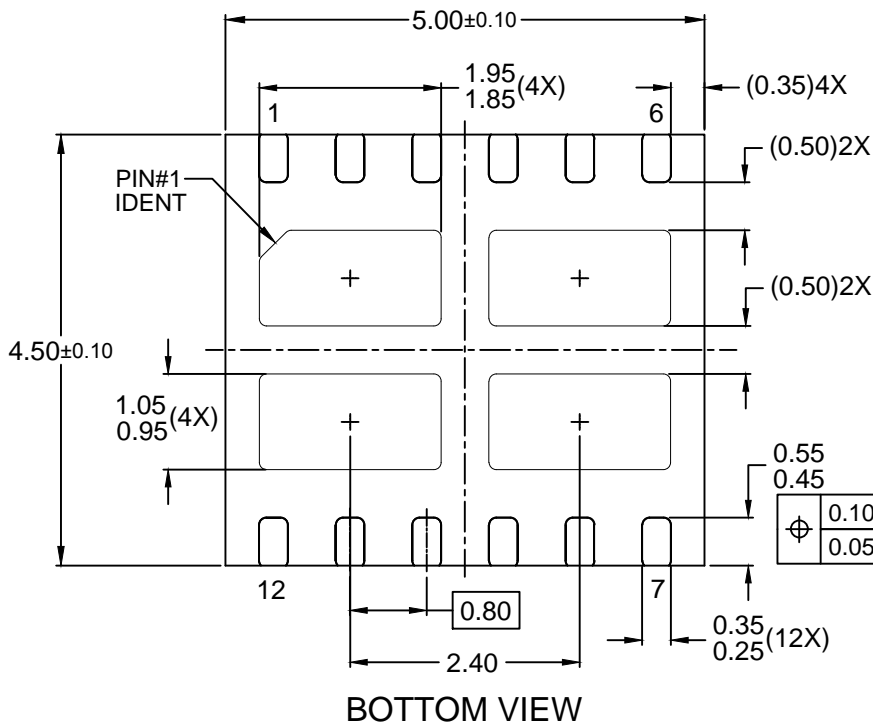
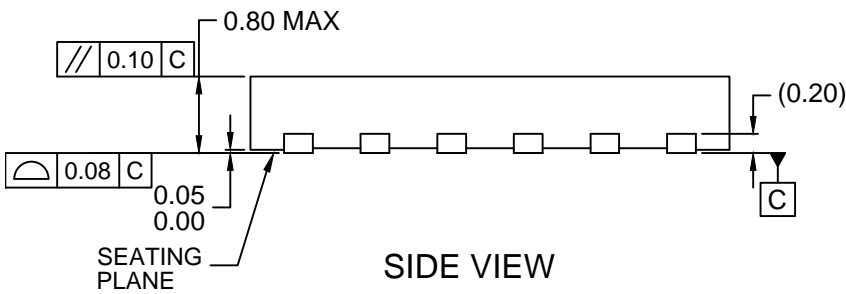
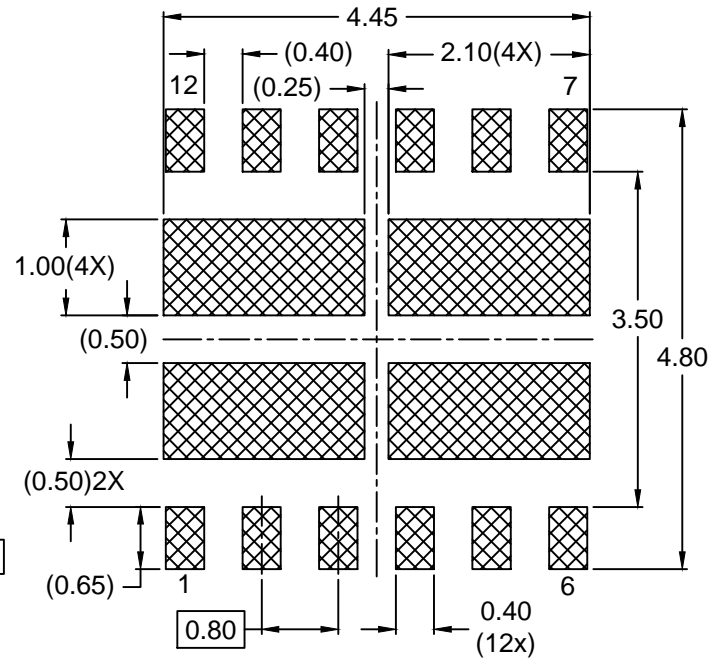
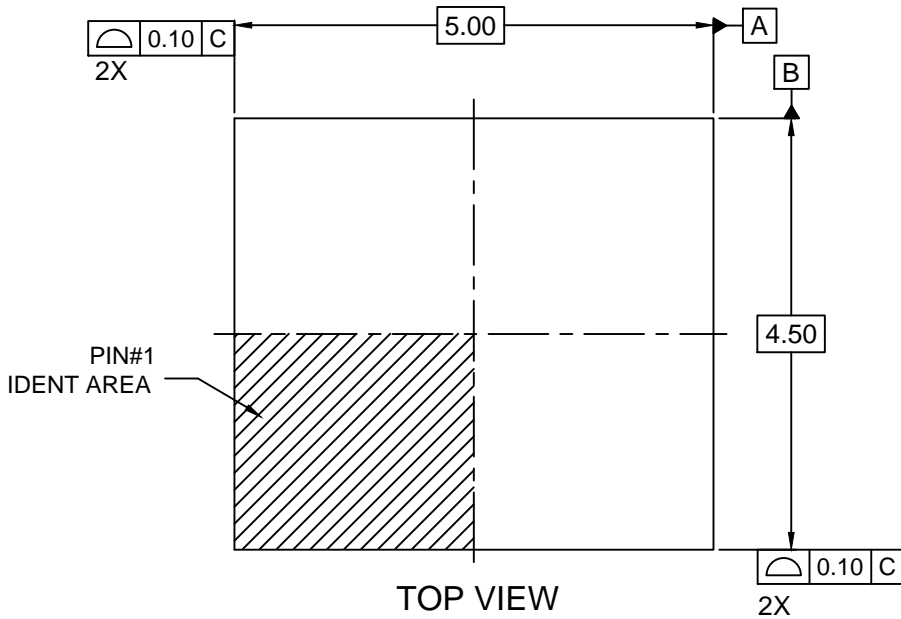


Figure 13. Leakage vs. Output Voltage Curve



NOTES:

- A. PACKAGE DOES NOT FULLY CONFORM TO JEDEC MO-229 REGISTRATION
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
- D. LAND PATTERN RECOMMENDATION IS BASED ON FSC DESIGN ONLY.
- E. DRAWING FILENAME: MKT-MLP12Erev2.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative