



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at

www.onsemi.com

ON Semiconductor and the ON Semiconductor logo 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.



FDMC89521L

Dual N-Channel PowerTrench[®] MOSFET

60 V, 8.2 A, 17 mΩ

Features

- Max $r_{DS(on)}$ = 17 mΩ at $V_{GS} = 10\text{ V}$, $I_D = 8.2\text{ A}$
- Max $r_{DS(on)}$ = 27 mΩ at $V_{GS} = 4.5\text{ V}$, $I_D = 6.7\text{ A}$
- Termination is Lead-free
- RoHS Compliant

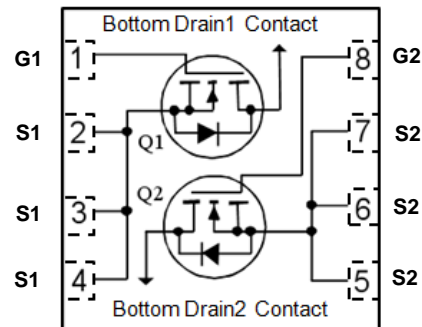
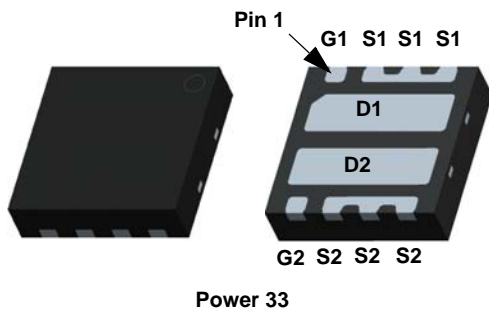


General Description

This device includes two 60 V N-Channel MOSFETs in a dual Power 33 (3 mm X 3 mm MLP) package. The package is enhanced for exceptional thermal performance.

Applications

- Battery Protection
- Load Switching
- Bridge Topologies



MOSFET Maximum Ratings $T_A = 25\text{ °C}$ unless otherwise noted.

Symbol	Parameter	Rated	Units
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current -Continuous	$T_A = 25\text{ °C}$ (Note 1a)	8.2
	-Pulsed		40
E_{AS}	Single Pulse Avalanche Energy	(Note 3)	32
P_D	Power Dissipation	$T_C = 25\text{ °C}$	16
	Power Dissipation	$T_A = 25\text{ °C}$ (Note 1a)	1.9
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^{\circ}\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	8.0	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	65	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	155	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC89521L	FDMC89521L	Power 33	13 "	12 mm	3000 units

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

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

Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		30		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\text{ }\mu\text{A}$	1	1.9	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$		-6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$, $I_D = 8.2\text{ A}$		13	17	m Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 6.7\text{ A}$		21	27	
		$V_{GS} = 10\text{ V}$, $I_D = 8.2\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$		20	26	
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}$, $I_D = 8.2\text{ A}$		28		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		1228	1635	pF
C_{oss}	Output Capacitance			243	325	pF
C_{rss}	Reverse Transfer Capacitance			10	15	pF
R_g	Gate Resistance			0.7		Ω

Switching Characteristics

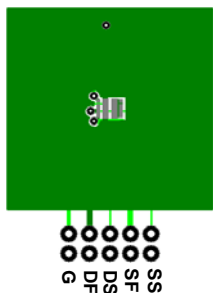
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}$, $I_D = 8.2\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		7.9	16	ns
t_r	Rise Time			2.1	10	ns
$t_{d(off)}$	Turn-Off Delay Time			18	33	ns
t_f	Fall Time			1.7	10	ns
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to } 10\text{ V}$		17	24	nC
Q_g	Total Gate Charge	$V_{GS} = 0\text{ V to } 4.5\text{ V}$	$V_{DD} = 30\text{ V}$, $I_D = 8.2\text{ A}$	7.9	12	nC
Q_{gs}	Gate to Source Charge			3.8		nC
Q_{gd}	Gate to Drain "Miller" Charge			1.9		nC

Drain-Source Diode Characteristics

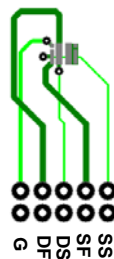
V_{SD}	Source-Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$, $I_S = 8.2\text{ A}$ (Note 2)		0.85	1.3	V
		$V_{GS} = 0\text{ V}$, $I_S = 1.6\text{ A}$ (Note 2)		0.75	1.2	
t_{rr}	Reverse Recovery Time	$I_F = 8.2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$		25	40	ns
Q_{rr}	Reverse Recovery Charge			11	20	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^2 pad of 2 oz copper pad on a $1.5 \times 1.5\text{ in.}$ 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. $65\text{ }^\circ\text{C/W}$ when mounted on a 1 in^2 pad of 2 oz copper



b. $155\text{ }^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < $300\text{ }\mu\text{s}$, Duty cycle < 2.0%.

3. E_{AS} of 32 mJ is based on starting $T_J = 25\text{ }^\circ\text{C}$, $L = 1\text{ mH}$, $I_{AS} = 8\text{ A}$, $V_{DD} = 54\text{ V}$, $V_{GS} = 10\text{ V}$. 100% tested at $L = 3\text{ mH}$, $I_{AS} = 5.4\text{ A}$.

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

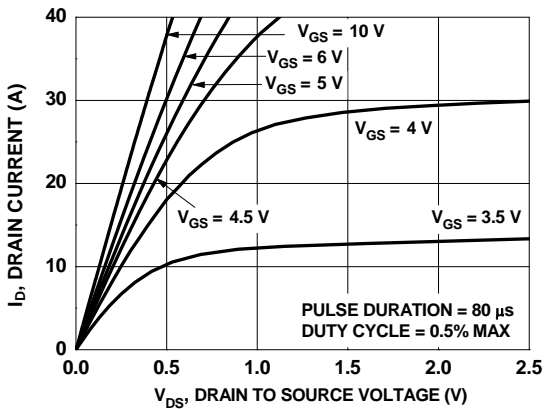


Figure 1. On Region Characteristics

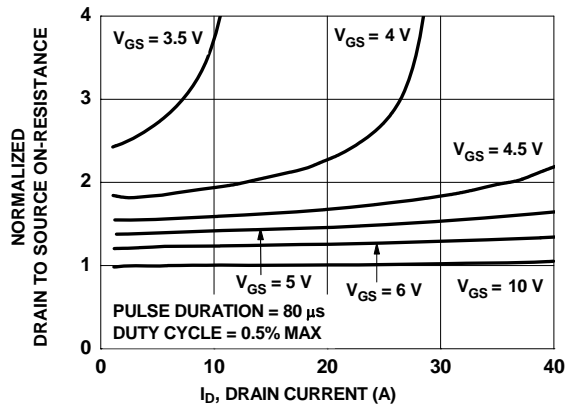


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

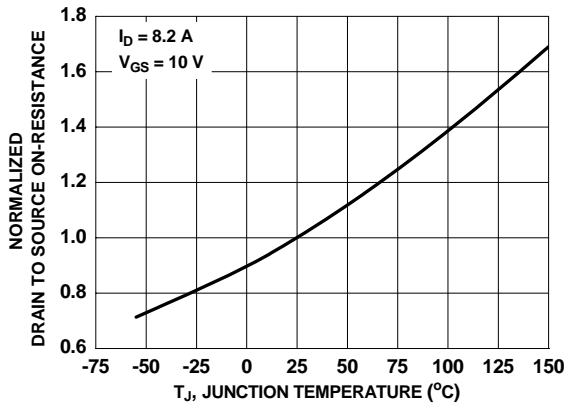


Figure 3. Normalized On Resistance vs. Junction Temperature

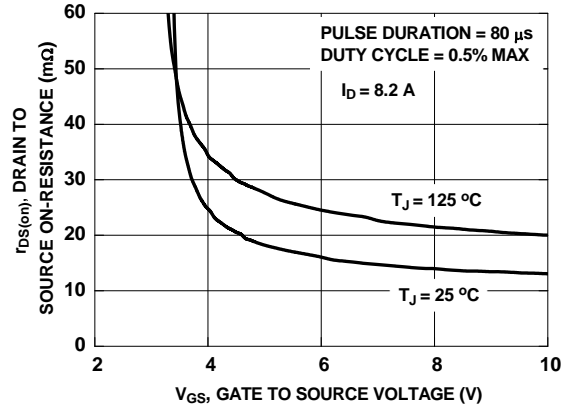


Figure 4. On-Resistance vs. Gate to Source Voltage

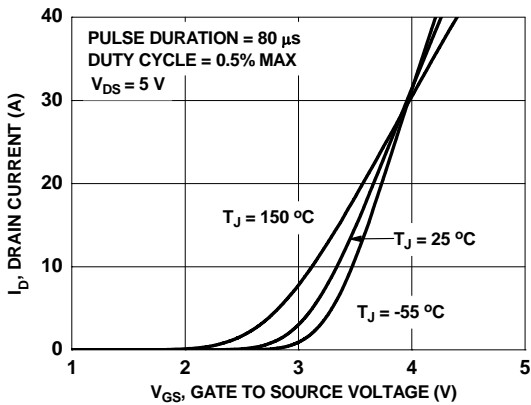


Figure 5. Transfer Characteristics

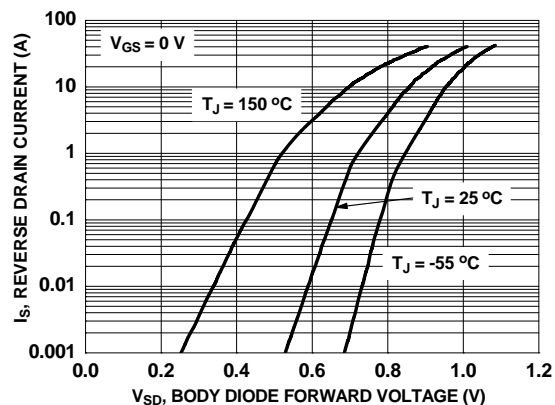


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

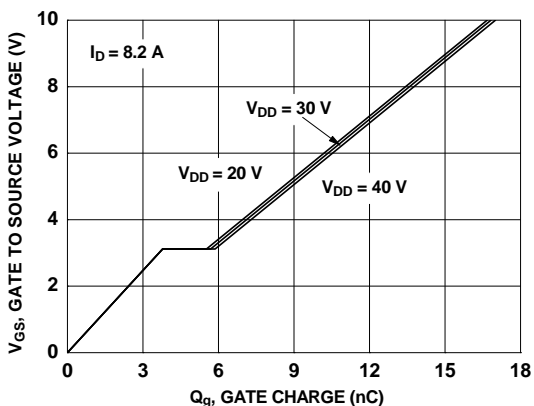


Figure 7. Gate Charge Characteristics

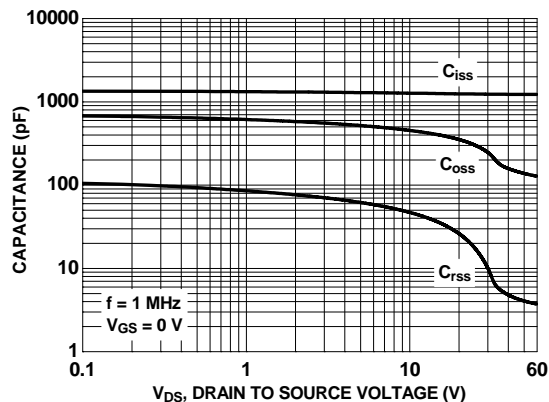


Figure 8. Capacitance vs. Drain to Source Voltage

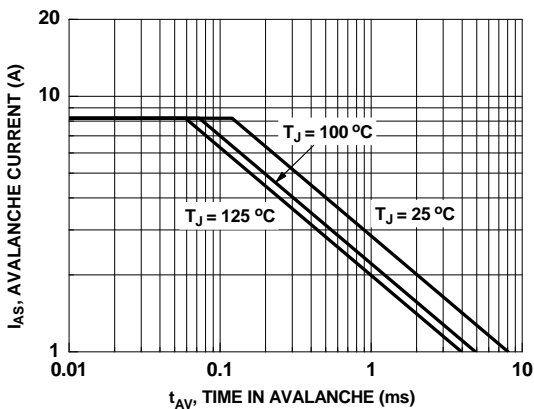


Figure 9. Unclamped Inductive Switching Capability

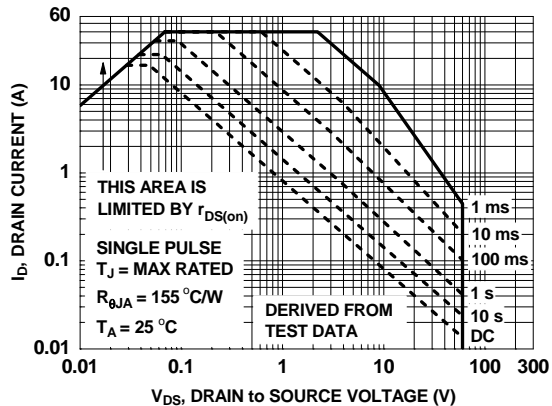


Figure 10. Forward Bias Safe Operating Area

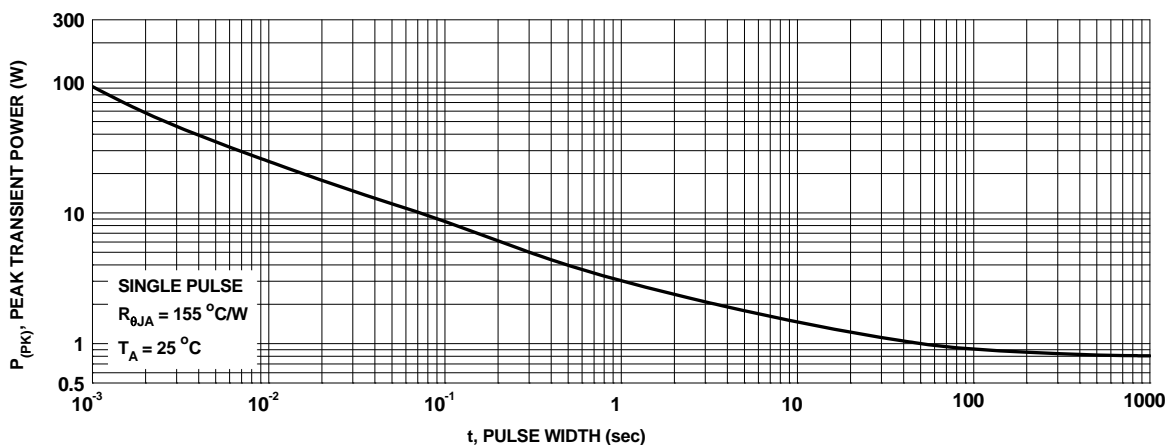


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

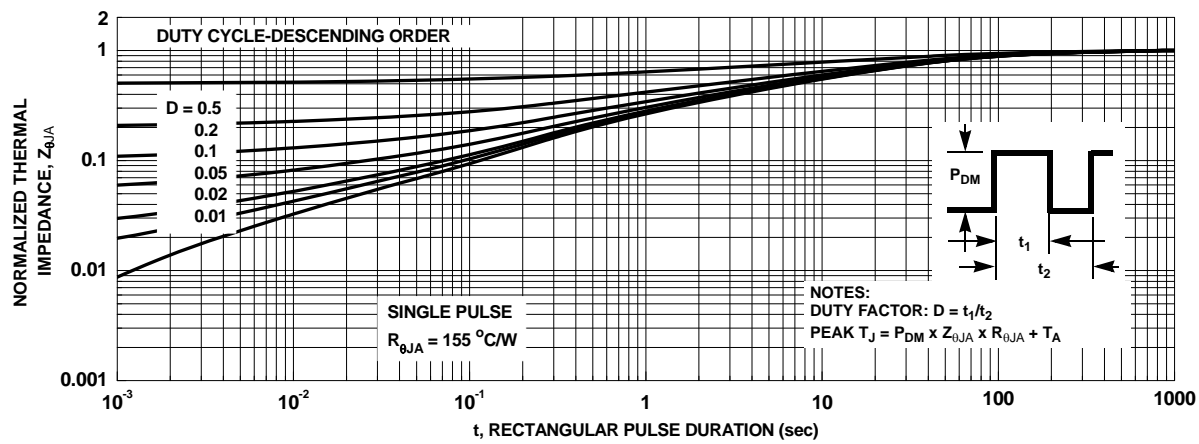
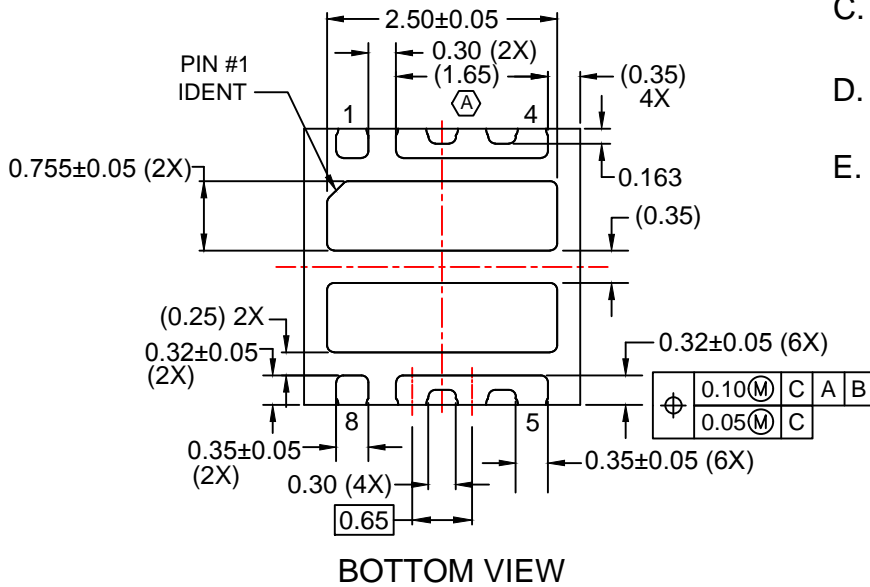
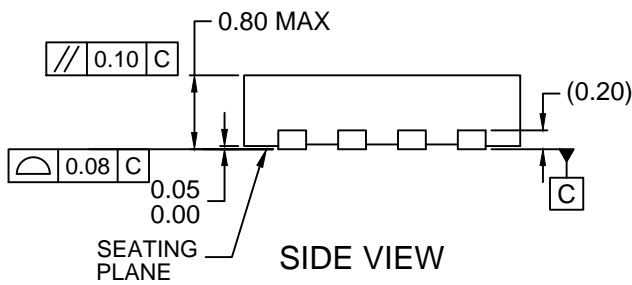
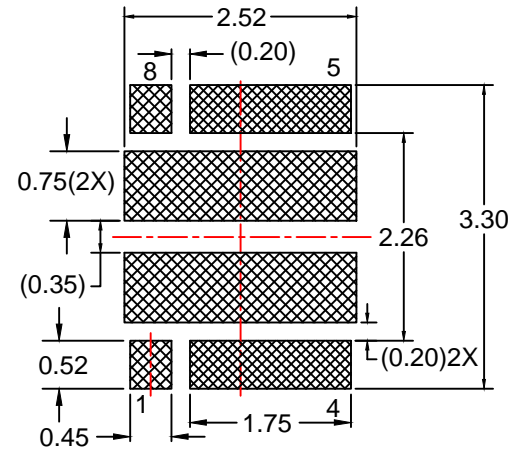
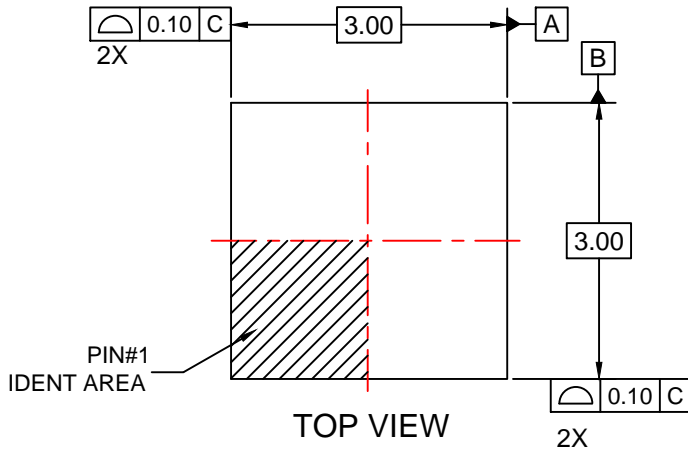


Figure 12. Junction-to-Ambient Transient Thermal Response Curve



RECOMMENDED LAND PATTERN

NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO-229.
- 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 FILE NAME: MKT-MLP08Xrev2.

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