



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.

FDZ1323NZ

Common Drain N-Channel 2.5 V PowerTrench® WL-CSP MOSFET

20 V, 10 A, 13 mΩ

Features

- Max $r_{S1S2(on)}$ = 13 mΩ at $V_{GS} = 4.5$ V, $I_{S1S2} = 1$ A
- Max $r_{S1S2(on)}$ = 13 mΩ at $V_{GS} = 3.8$ V, $I_{S1S2} = 1$ A
- Max $r_{S1S2(on)}$ = 16 mΩ at $V_{GS} = 3.1$ V, $I_{S1S2} = 1$ A
- Max $r_{S1S2(on)}$ = 18 mΩ at $V_{GS} = 2.5$ V, $I_{S1S2} = 1$ A
- Occupies only 3 mm² of PCB area
- Ultra-thin package: less than 0.35 mm height when mounted to PCB
- High power and current handling capability
- HBM ESD protection level > 3.6 kV (Note 3)
- RoHS Compliant

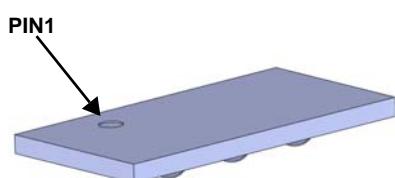


General Description

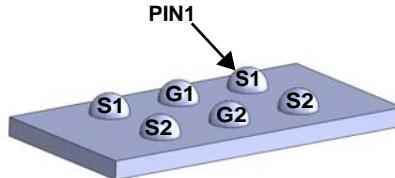
This device is designed specifically as a single package solution for Li-Ion battery pack protection circuit and other ultra-portable applications. It features two common drain N-channel MOSFETs, which enables bidirectional current flow, on Fairchild's advanced PowerTrench® process with state of the art "low pitch" WL-CSP packaging process, the FDZ1323NZ minimizes both PCB space and $r_{S1S2(on)}$. This advanced WL-CSP MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, ultra-low profile packaging, low gate charge and low $r_{S1S2(on)}$.

Applications

- Battery management
- Load switch
- Battery protection

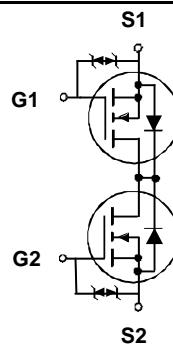


TOP



BOTTOM

WL-CSP 1.3X2.3



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{S1S2}	Source1 to Source2 Voltage	20	V
V_{GS}	Gate to Source Voltage	± 12	V
I_{S1S2}	Source1 to Source2 Current -Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	10	A
	-Pulsed	40	
P_D	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1b)	0.5	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	62	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	257	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
EC	FDZ1323NZ	WL-CSP 1.3X2.3	7 "	8 mm	5000 units

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

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

Off Characteristics

I_{S1S2}	Zero Gate Voltage Source1 to Source2 Current	$V_{S1S2} = 16\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 12\text{ V}$, $V_{S1S2} = 0\text{ V}$			± 10	μA

On Characteristics

$V_{GS(\text{th})}$	Gate to Source Threshold Voltage	$V_{GS} = V_{S1S2}$, $I_{S1S2} = 250\text{ }\mu\text{A}$	0.4	0.9	1.2	V
$r_{S1S2(\text{on})}$	Static Source1 to Source2 On Resistance	$V_{GS} = 4.5\text{ V}$, $I_{S1S2} = 1\text{ A}$	4.5	9.7	13	$\text{m}\Omega$
		$V_{GS} = 3.8\text{ V}$, $I_{S1S2} = 1\text{ A}$	5.5	10	13	
		$V_{GS} = 3.1\text{ V}$, $I_{S1S2} = 1\text{ A}$	7	11	16	
		$V_{GS} = 2.5\text{ V}$, $I_{S1S2} = 1\text{ A}$	8	13	18	
		$V_{GS} = 4.5\text{ V}$, $I_{S1S2} = 1\text{ A}$, $T_J = 125^\circ\text{C}$		13	20	
g_{FS}	Forward Transconductance	$V_{S1S2} = 5\text{ V}$, $I_{S1S2} = 1\text{ A}$		9		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{S1S2} = 10\text{ V}$, $V_{GS} = 0\text{ V}$		1545	2055	pF
C_{oss}	Output Capacitance	$f = 1\text{ MHz}$		269	405	pF
C_{rss}	Reverse Transfer Capacitance			252	380	pF

Switching Characteristics

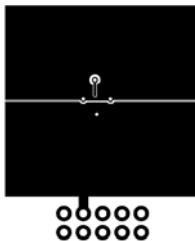
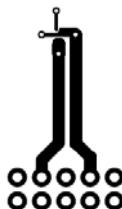
$t_{d(\text{on})}$	Turn-On Delay Time			12	22	ns
t_r	Rise Time	$V_{S1S2} = 10\text{ V}$, $I_{S1S2} = 1\text{ A}$		13	23	ns
$t_{d(\text{off})}$	Turn-Off Delay Time	$V_{GS} = 4.5\text{ V}$, $R_{\text{GEN}} = 6\Omega$		34	54	ns
t_f	Fall Time			13	23	ns
Q_g	Total Gate Charge			17	24	nC
Q_{gs}	Gate to Source1 Gate Charge	$V_{S1S2} = 10\text{ V}$, $I_{S1S2} = 1\text{ A}$, $V_{G1S1} = 4.5\text{ V}$, $V_{G2S2} = 0\text{ V}$		1.9		nC
Q_{gd}	Gate to Source2 "Miller" Charge			5.4		nC

Source1 to Source2 Diode Characteristics

I_{fss}	Maximum Continuous Source1 to Source2 Diode Forward Current			1	A	
V_{fss}	Source1 to Source2 Diode Forward Voltage	$V_{G1S1} = 0\text{ V}$, $V_{G2S2} = 4.5\text{ V}$, $I_{fss} = 1\text{ A}$	(Note 2)	0.6	1.2	V

Notes:

1. R_{QJA} 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_{QJC} is guaranteed by design while R_{QCA} is determined by the user's board design.

a. 62 °C/W when mounted on a 1 in² pad of 2 oz copper.

b. 257 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300 us, Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only protection against ESD. No gate overvoltage rating is implied.

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

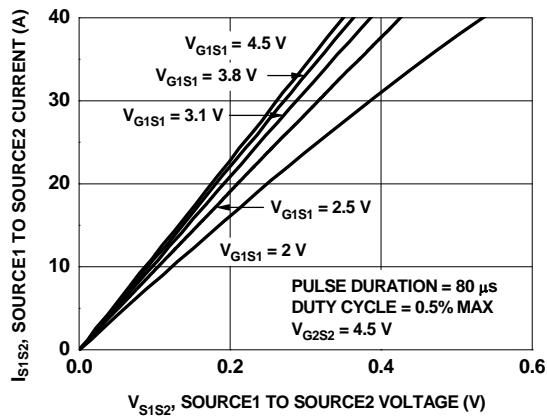


Figure 1. On-Region Characteristics

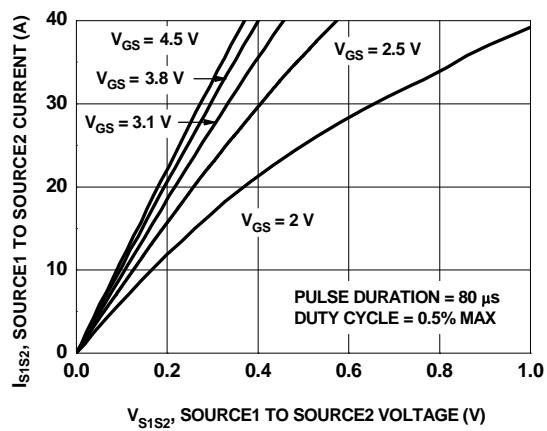


Figure 2. On-Region Characteristics

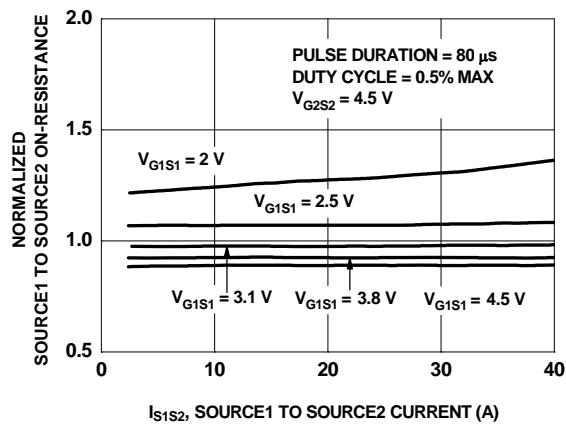


Figure 3. Normalized On-Resistance vs Source1 to Source2 Current and Gate Voltage

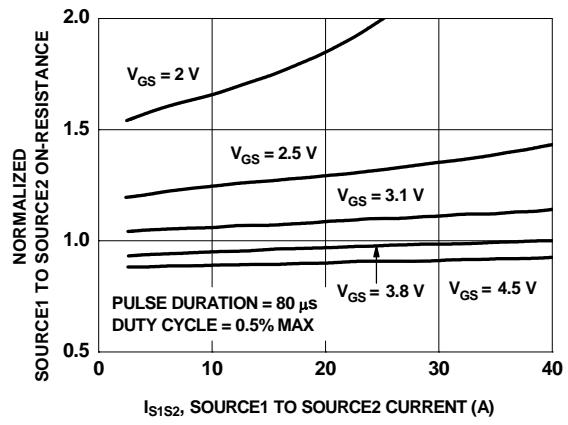


Figure 4. Normalized On-Resistance vs Source1 to Source2 Current and Gate Voltage

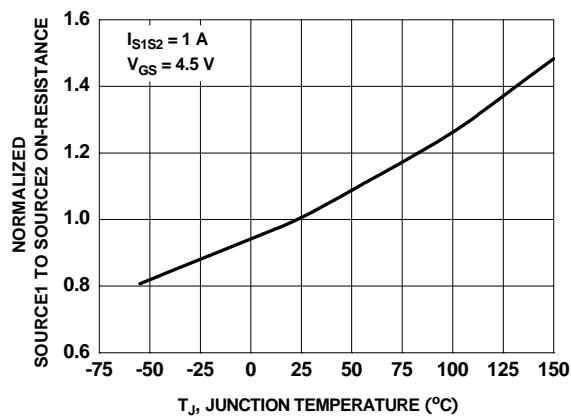


Figure 5. Normalized On Resistance vs Junction Temperature

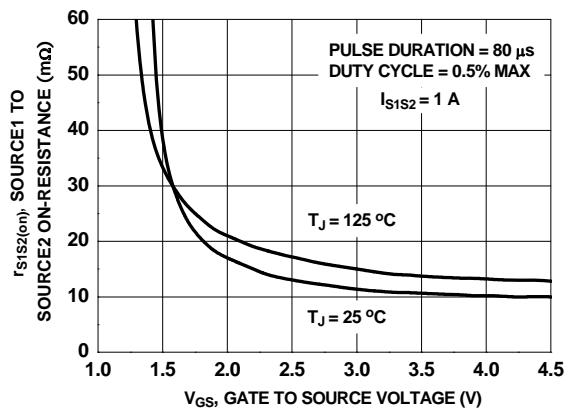


Figure 6. On Resistance vs Gate to Source Voltage

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

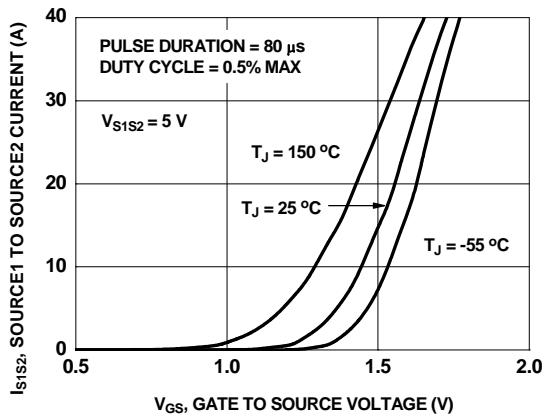


Figure 7. Transfer Characteristics

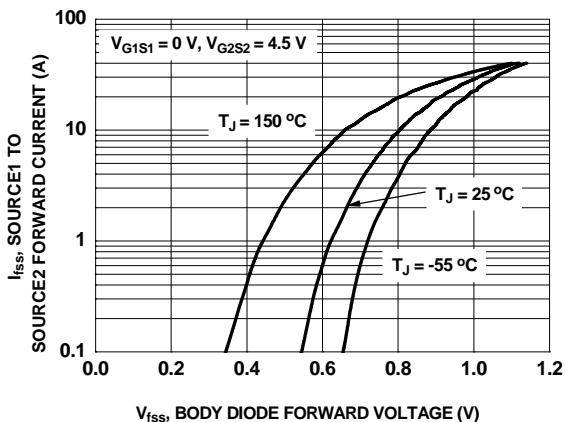


Figure 8. Source1 to Source2 Diode Forward Voltage vs Source Current

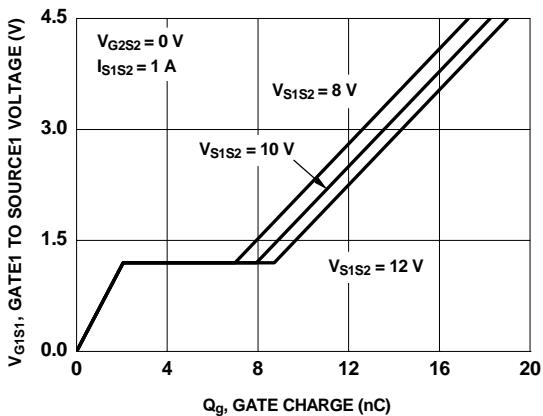


Figure 9. Gate Charge Characteristics

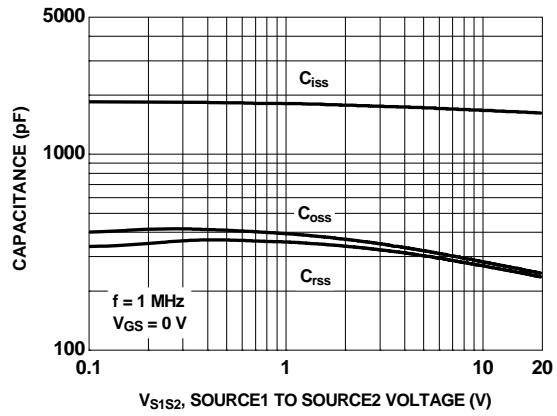


Figure 10. Capacitance vs Source1 to Source2 Voltage

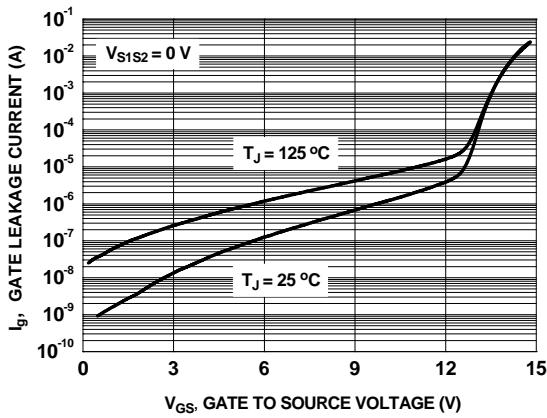


Figure 11. Gate Leakage Current vs Gate to Source Voltage

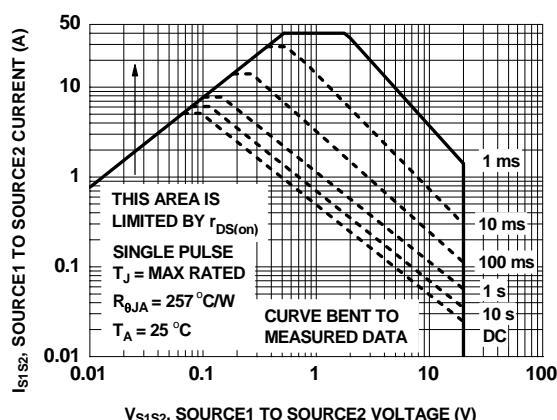


Figure 12. Forward Bias Safe Operating Area

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

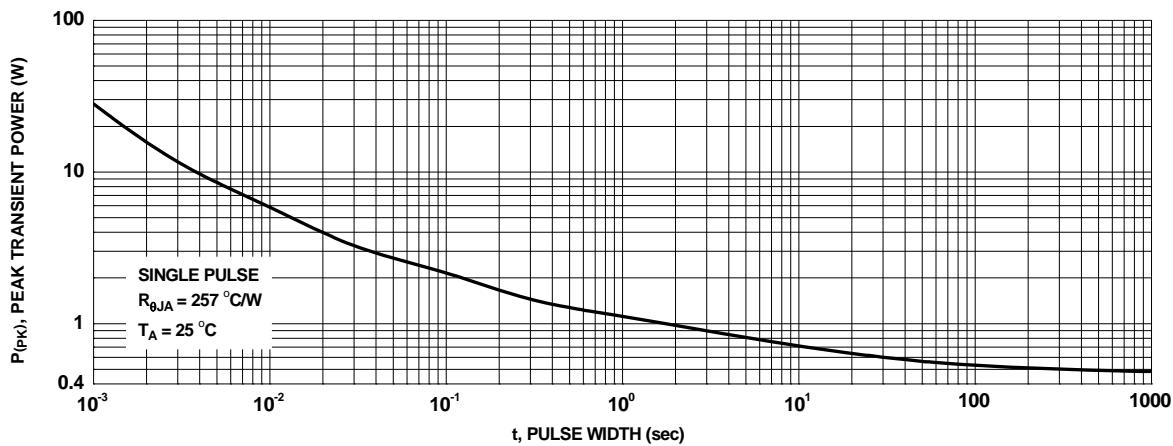


Figure 13. Single Pulse Maximum Power Dissipation

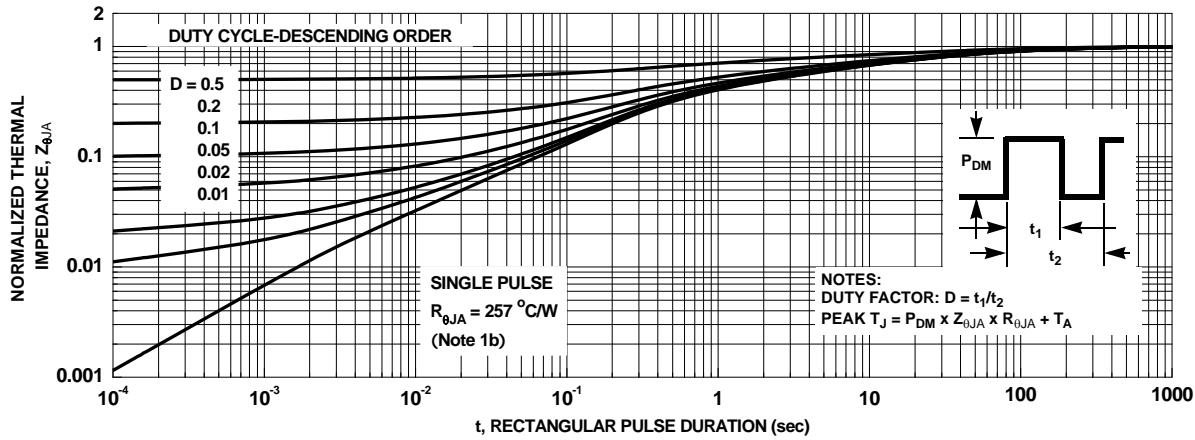
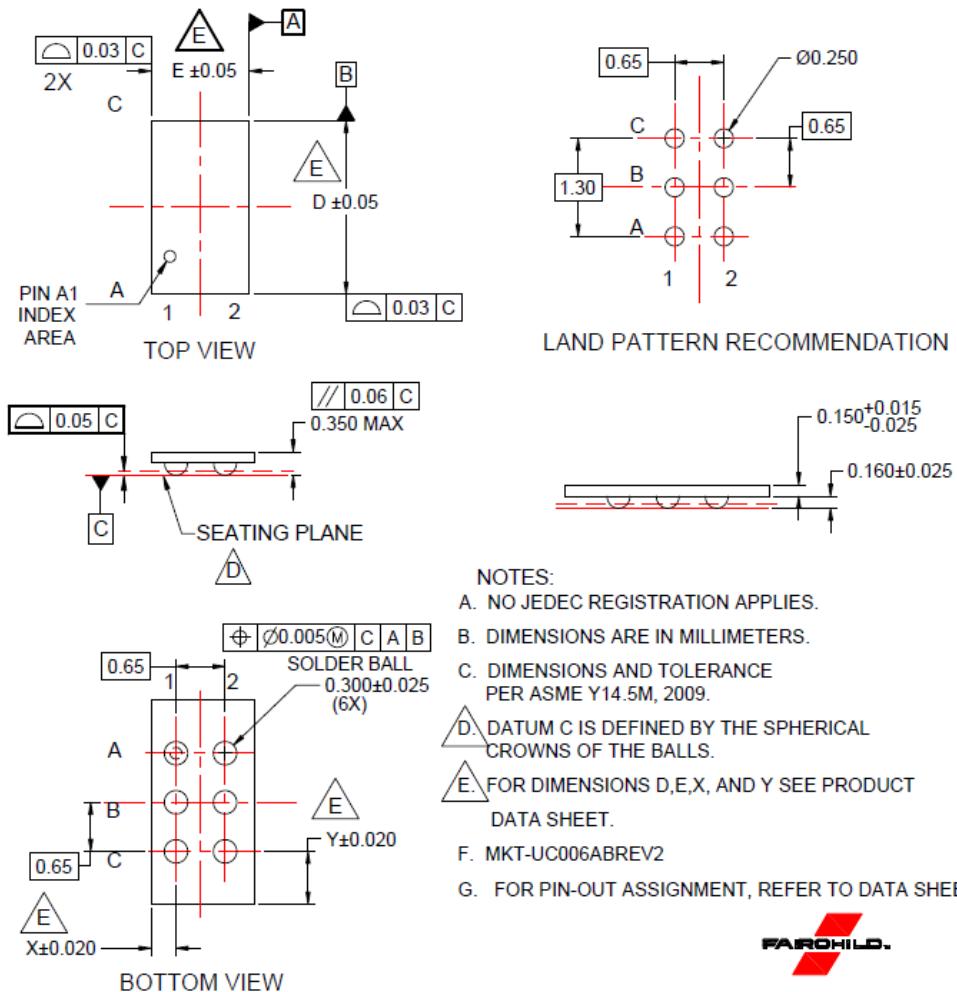


Figure 14. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



Pin Definitions:

Gate	Source1	Source2
B1, B2	A1, C1	A2, C2

Product Specific Dimensions:

D	E	X	Y
2.3 mm	1.3 mm	0.315 mm	0.49 mm

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
http://www.fairchildsemi.com/package/packageDetails.html?id=PN_UCBEA-006

**TRADEMARKS**

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™
 Awinda®
 AX-CAP®*
 BitSiC™
 Build it Now™
 CorePLUS™
 CorePOWER™
 CROSSVOLT™
 CTL™
 Current Transfer Logic™
 DEUXPEED®
 Dual Cool™
 EcoSPARK®
 EfficientMax™
 ESBC™

 Fairchild®
 Fairchild Semiconductor®
 FACT Quiet Series™
 FACT®
 FAST®
 FastvCore™
 FETBench™
 FPS™

 F™

F-PFS™
 FRFET®
 Global Power Resource™
 GreenBridge™
 Green FPSTM
 Green FPSTM e-Series™
 Gmax™
 GTO™
 IntelliMAX™
 ISOPLANAR™
 Marking Small Speakers Sound Louder and Better™
 MegaBuck™
 MICROCOUPLER™
 MicroFET™
 MicroPak™
 MicroPak2™
 MillerDrive™
 MotionMax™
 MotionGrid®
 MTI®
 MTx®
 MVN®
 mWSaver®
 OptoHiTT™

PowerTrench®
 PowerXS™
 Programmable Active Droop™
 QFET®
 QS™
 Quiet Series™
 RapidConfigure™

 Saving our world, 1mW/W/kW at a time™
 SignalWise™
 SmartMax™
 SMART START™
 Solutions for Your Success™
 SPM®
 STEALTH™
 SuperFET®
 SuperSOT™-3
 SuperSOT™-6
 SuperSOT™-8
 SupreMOS®
 SyncFET™
 Sync-Lock™

E SYSTEM®
 GENERAL
 TinyBoost®
 TinyBuck®
 TinyCalc™
 TinyLogic®
 TINYOPTO™
 TinyPower™
 TinyPWM™
 TinyWire™
 TransiC™
 TriFault Detect™
 TRUECURRENT®*
 μSerDes™

 μ SerDes™
 UHC®
 Ultra FRFET™
 UniFET™
 VCX™
 VisualMax™
 VoltagePlus™
 XSTM
 Xsens™
 仙童™

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://WWW.FAIRCHILDSEMI.COM). FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS**Definition of Terms**

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I71

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