

# ON Semiconductor

## Is Now

# onsemi™

To learn more about onsemi™, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

---

**onsemi** and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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 **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** 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 **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.



ON Semiconductor®

# Advanced Power MOSFET

# IRFM120A

## FEATURES

## IEEE802.3af Compatible

- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 100V$
- Lower  $R_{DS(ON)}$  : 0.155  $\Omega$  (Typ.)

$$BV_{DSS} = 100 V$$

$$R_{DS(on)} = 0.2 \Omega$$

$$I_D = 2.3 A$$

### SOT-223



1. Gate 2. Drain 3. Source

## Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	100	V
$I_D$	Continuous Drain Current ( $T_A=25^\circ C$ )	2.3	A
	Continuous Drain Current ( $T_A=70^\circ C$ )	1.84	
$I_{DM}$	Drain Current-Pulsed <sup>①</sup>	18	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy <sup>②</sup>	123	mJ
$I_{AR}$	Avalanche Current <sup>①</sup>	2.3	A
$E_{AR}$	Repetitive Avalanche Energy <sup>①</sup>	0.24	mJ
dv/dt	Peak Diode Recovery dv/dt <sup>③</sup>	6.5	V/ns
$P_D$	Total Power Dissipation ( $T_A=25^\circ C$ ) *	2.4	W
	Linear Derating Factor *	0.019	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	- 55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds	300	

## Thermal Resistance

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JA}$	Junction-to-Ambient *	--	52	$^\circ C/W$

\* When mounted on the minimum pad size recommended (PCB Mount).

## Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$BV_{DSS}$	Drain-Source Breakdown Voltage	100	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV/\Delta T_J$	Breakdown Voltage Temp. Coeff.	--	0.12	--	V/ $^\circ\text{C}$	$I_D=250\mu A$ <b>See Fig 7</b>
$V_{GS(th)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=5V, I_D=250\mu A$
$I_{GSS}$	Gate-Source Leakage, Forward	--	--	100	nA	$V_{GS}=20V$
	Gate-Source Leakage, Reverse	--	--	-100		$V_{GS}=-20V$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	1	$\mu A$	$V_{DS}=30V$ ⑥
		--	--	10		$V_{DS}=100V$
		--	--	100		$V_{DS}=80V, T_A=125^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-State Resistance	--	--	0.2	$\Omega$	$V_{GS}=10V, I_D=1.15A$ ④
$g_{fs}$	Forward Transconductance	--	3.12	--	S	$V_{DS}=40V, I_D=1.15A$ ④
$C_{iss}$	Input Capacitance	--	370	480	pF	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ <b>See Fig 5</b>
$C_{oss}$	Output Capacitance	--	95	110		
$C_{riss}$	Reverse Transfer Capacitance	--	38	45		
$t_{d(on)}$	Turn-On Delay Time	--	14	40	ns	$V_{DD}=50V, I_D=9.2A,$ $R_G=18\Omega$ <b>See Fig 13</b> ④ ⑤
$t_r$	Rise Time	--	14	40		
$t_{d(off)}$	Turn-Off Delay Time	--	36	90		
$t_f$	Fall Time	--	28	70		
$Q_g$	Total Gate Charge	--	16	22	nC	$V_{DS}=80V, V_{GS}=10V,$ $I_D=9.2A$ <b>See Fig 6 &amp; Fig 12</b> ④ ⑤
$Q_{gs}$	Gate-Source Charge	--	2.7	--		
$Q_{gd}$	Gate-Drain("Miller") Charge	--	7.8	--		

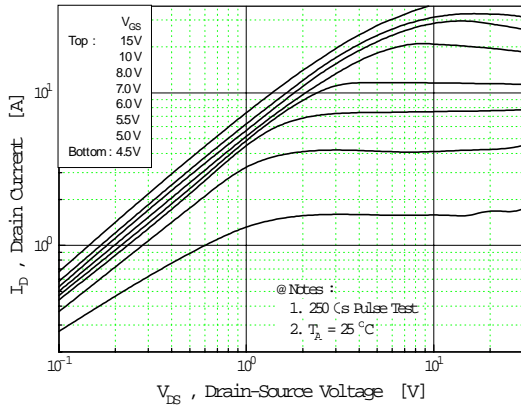
## Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
$I_S$	Continuous Source Current	--	--	2.3	A	Integral reverse pn-diode in the MOSFET
$I_{SM}$	Pulsed-Source Current ①	--	--	18		
$V_{SD}$	Diode Forward Voltage ④	--	--	1.5	V	$T_J=25^\circ\text{C}, I_S=2.3A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time	--	98	--	ns	$T_J=25^\circ\text{C}, I_F=9.2A$
$Q_{rr}$	Reverse Recovery Charge	--	0.34	--	$\mu C$	$di_F/dt=100A/\mu s$ ④

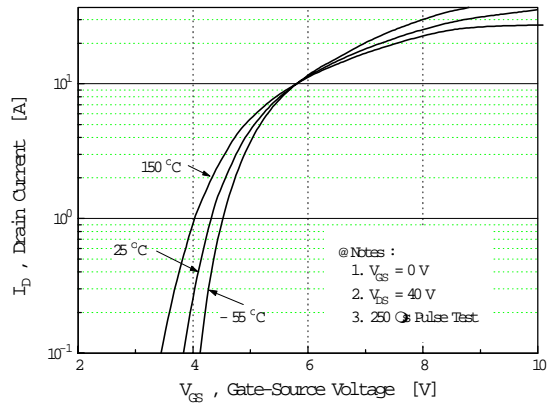
### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=35\text{mH}, I_{AS}=2.3A, V_{DD}=25V, R_G=27\Omega,$  Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD}\leq 9.2A, di/dt\leq 300A/\mu s, V_{DD}\leq BV_{DSS},$  Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu s,$  Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature
- ⑥ Adjusted for Cisco

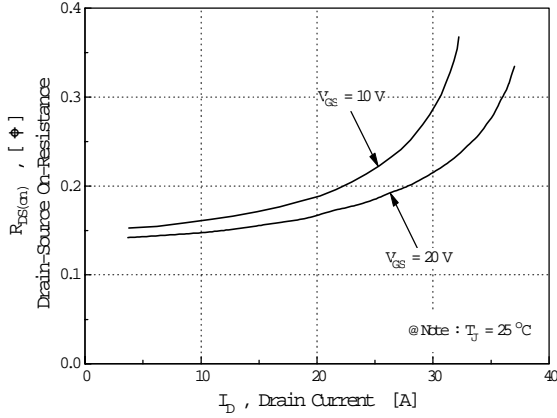
**Fig 1. Output Characteristics**



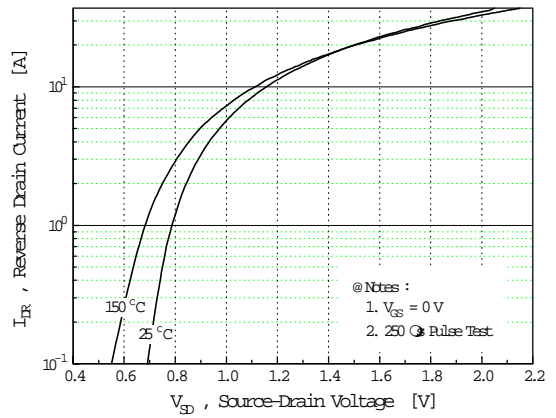
**Fig 2. Transfer Characteristics**



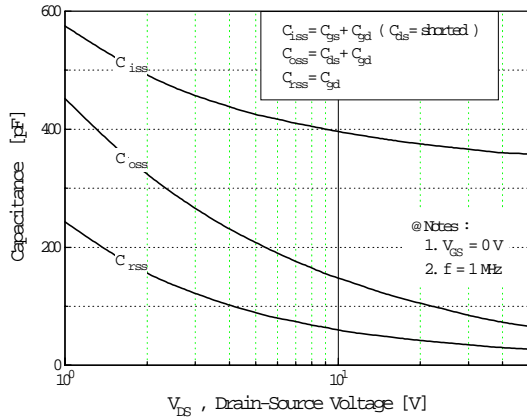
**Fig 3. On-Resistance vs. Drain Current**



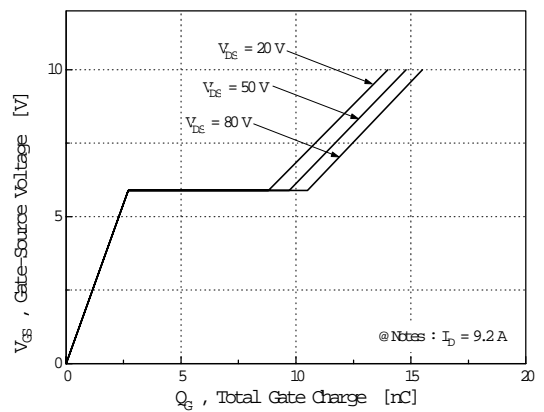
**Fig 4. Source-Drain Diode Forward Voltage**



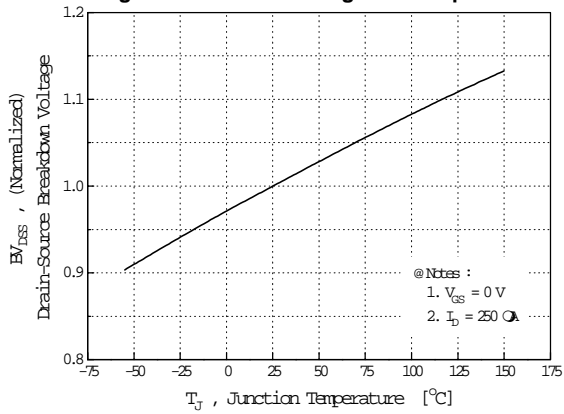
**Fig 5. Capacitance vs. Drain-Source Voltage**



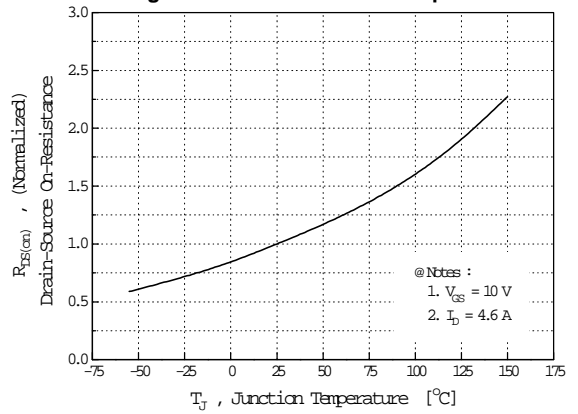
**Fig 6. Gate Charge vs. Gate-Source Voltage**



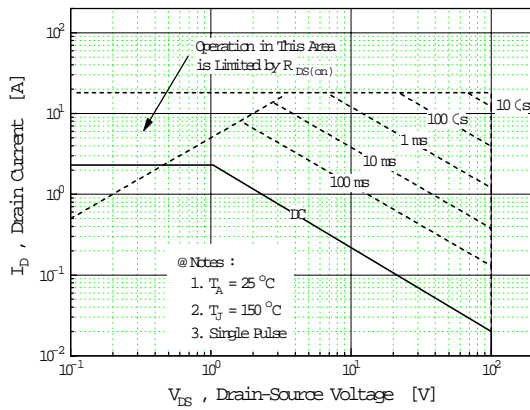
**Fig 7. Breakdown Voltage vs. Temperature**



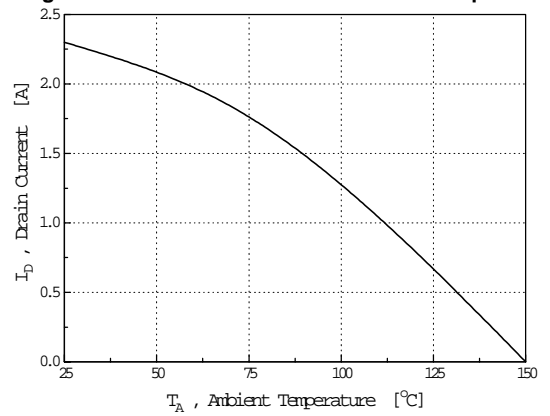
**Fig 8. On-Resistance vs. Temperature**



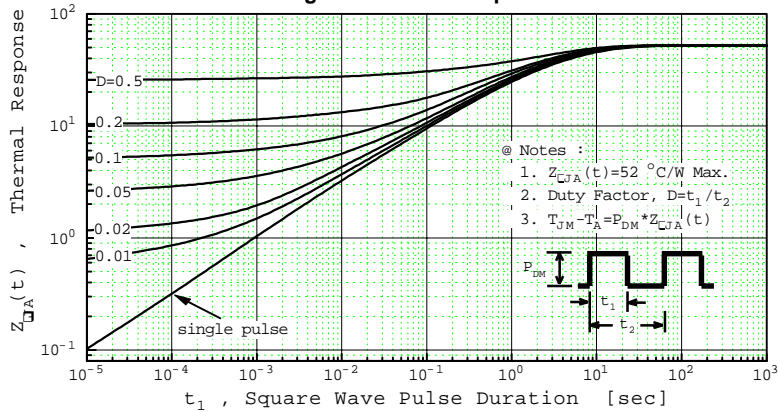
**Fig 9. Max. Safe Operating Area**



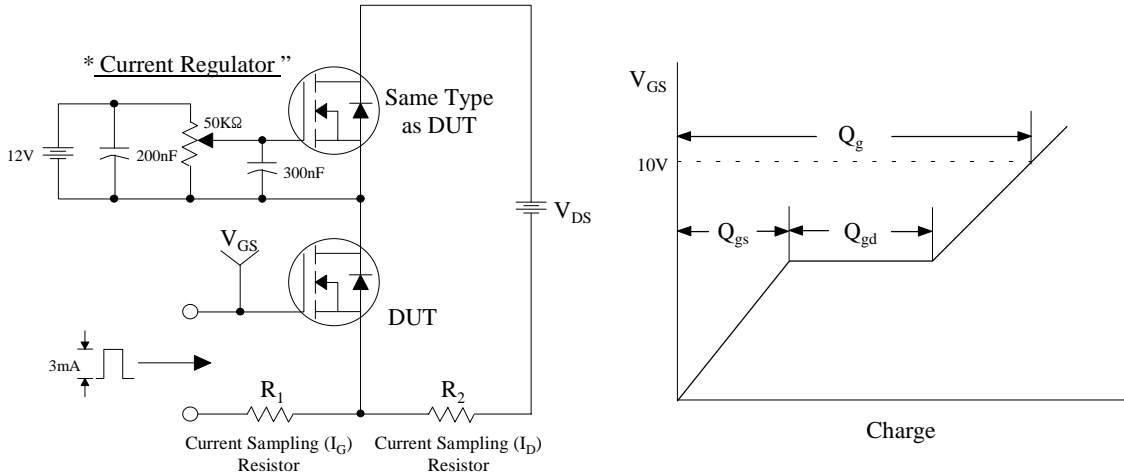
**Fig 10. Max. Drain Current vs. Ambient Temperature**



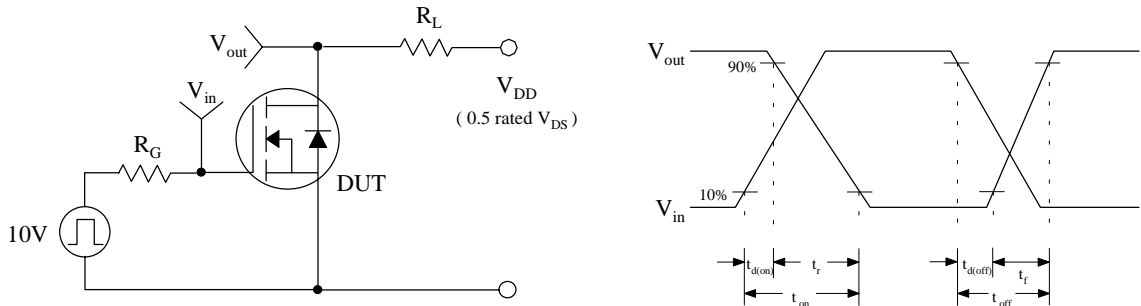
**Fig 11. Thermal Response**



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

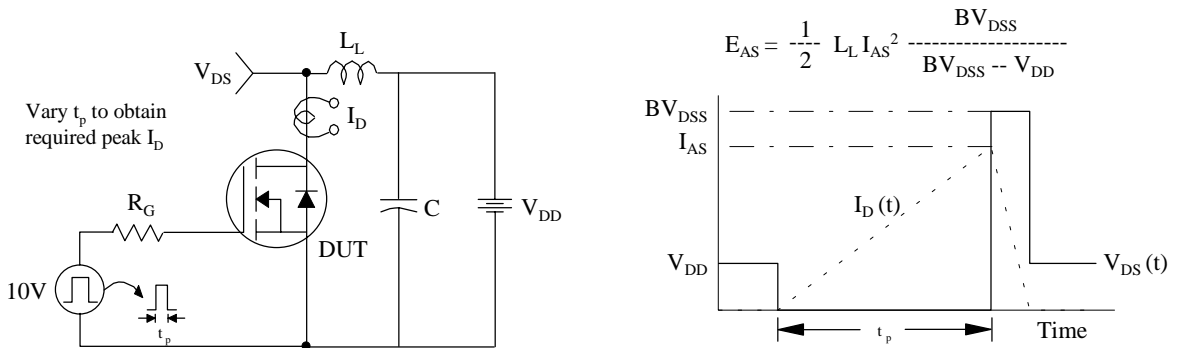
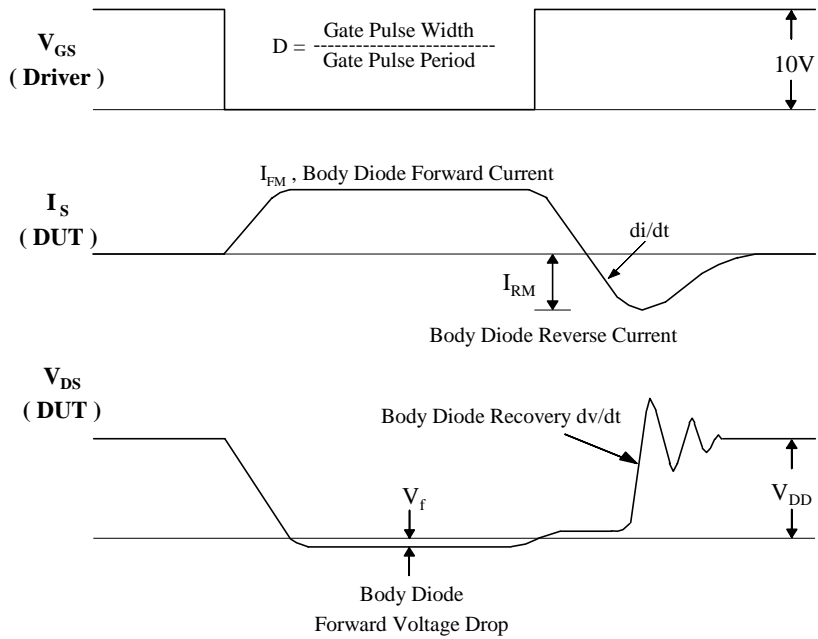
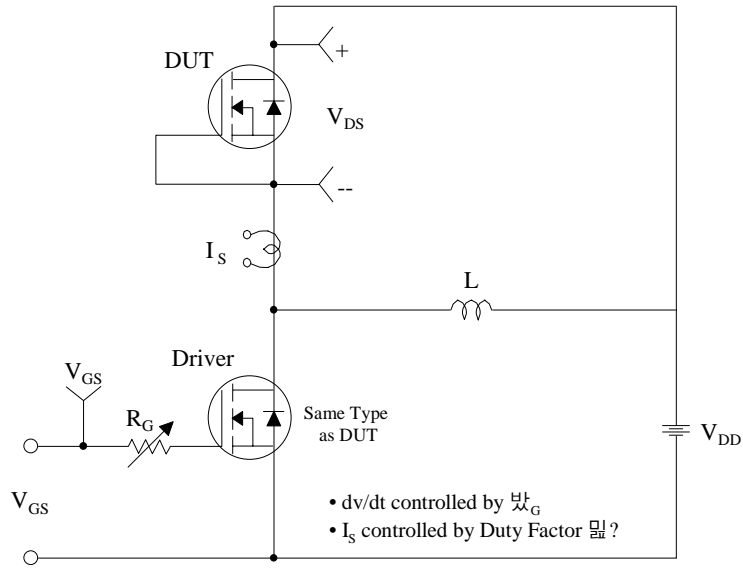


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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](http://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](mailto: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](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative



# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[onsemi:](#)

[IRFM120ATF](#)