

Is Now Part of



## **ON Semiconductor**®

# To learn more about ON Semiconductor, please visit our website at <u>www.onsemi.com</u>

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (\_), the underscore (\_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (\_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at <a href="mailto:www.onsemi.com">www.onsemi.com</a>. Please email any questions regarding the system integration to <a href="mailto:Fairchild\_questions@onsemi.com">Fairchild\_questions@onsemi.com</a>.

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 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 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 unavteries, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out or i, 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 and is officers, employees, uniotificated use, even if such claim any manner.



### **FGA20S140P** 1400 V, 20 A Shorted-anode IGBT

#### **Features**

- High Speed Switching
- Low Saturation Voltage: V<sub>CE(sat)</sub> =1.9 V @ I<sub>C</sub> = 20 A
- High Input Impedance
- RoHS Compliant

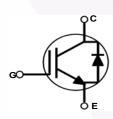
#### Applications

Induction Heating, Microwave Oven

### **General Description**

Using advanced field stop trench and shorted-anode technology, Fairchild's shorted-anode trench IGBTs offer superior conduction and switching performances for soft switching applications. The device can operate in parallel configuration with exceptional avalanche capability. This device is designed for induction heating and microwave oven.





#### Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Description		Ratings	Unit V	
V <sub>CES</sub>	Collector to Emitter Voltage	1400			
V <sub>GES</sub>	Gate to Emitter Voltage		±25	V	
I <sub>C</sub>	Collector Current @ $T_{\rm C} = 25^{\circ}{\rm C}$		40	A	
	Collector Current	@ T <sub>C</sub> = 100 <sup>o</sup> C	20	A	
I <sub>CM (1)</sub>	Pulsed Collector Current		60	A	
I <sub>F</sub>	Diode Continuous Forward Current @ T <sub>C</sub> = 25°C		40	A	
I <sub>F</sub>	Diode Continuous Forward Current	@ T <sub>C</sub> = 100 <sup>o</sup> C	20	A	
P <sub>D</sub>	Maximum Power Dissipation $@ T_{C} = 25^{\circ}C$		272	W	
	Maximum Power Dissipation	@ T <sub>C</sub> = 100°C	136	W	
TJ	Operating Junction Temperature		-55 to +175	°C	
T <sub>stg</sub>	Storage Temperature Range		-55 to +175	°C	
TL	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°C	

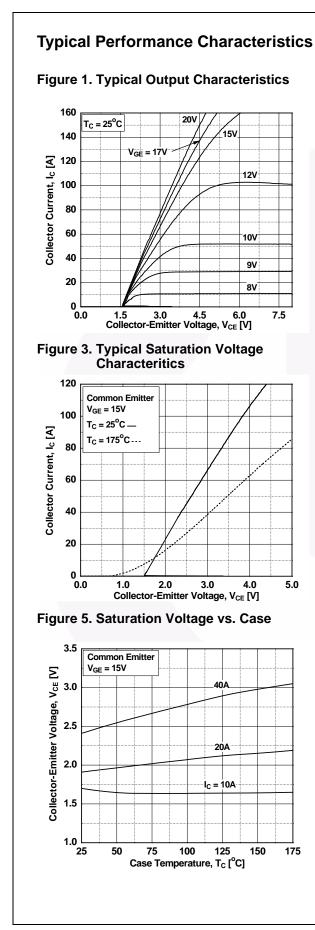
#### **Thermal Characteristics**

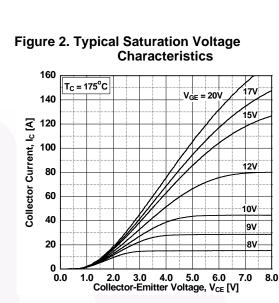
Symbol	Parameter	Тур.	Max.	Unit
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case		0.55	°C/W
$R_{ extsf{ heta}JA}$	Thermal Resistance, Junction to Ambient		40	°C/W

Notes: 1: Limited by Tjmax

September 2013

		ackageReel SizeTO-3PN-		Таре	Tape Width		Quantity	
				-		30		
Electric	al Char	acteristics of the I	GBT T <sub>c = 25</sub>	5°C unless otherwise noted	1			
Symbol		Parameter	Test	Conditions	Min.	Тур.	Max.	Unit
Off Charac	teristics							
I <sub>CES</sub>	Collector C	Cut-Off Current	V <sub>CE</sub> = 1400,	$V_{GE} = 0V$	-	-	1	mA
I <sub>GES</sub>	G-E Leakage Current		$V_{GE} = V_{GES}, V_{CE} = 0V$		-	-	±500	nA
On Charac	teristics							
V <sub>GE(th)</sub>		hold Voltage	I <sub>C</sub> = 20mA, \	V <sub>CE</sub> = V <sub>GE</sub>	4.5	6.0	7.5	V
			$I_{C} = 20A, V_{GE} = 15V$ $T_{C} = 25^{\circ}C$		-	1.9	2.4	V
V <sub>CE(sat)</sub> Collector		o Emitter Saturation Voltage	$I_{\rm C} = 20$ A, $V_{\rm G}$ $T_{\rm C} = 125^{\circ}$ C	<sub>E</sub> = 15V,	-	2.1	-	V
			$I_{C} = 20A, V_{GE} = 15V,$ $T_{C} = 175^{\circ}C$		-	2.2	-	V
V <sub>FM</sub>	Diode Forward Voltage		I <sub>F</sub> = 20A, T <sub>C</sub>	= 25°C	-	1.7	2.4	V
FM Diode Forward Voldge			I <sub>F</sub> = 20A, T <sub>C</sub> = 175°C		-	2.1	-	V
Dynamic C	baractorist	ios						
C <sub>ies</sub>	Input Capa				_	1686	-	pF
C <sub>oes</sub>		Putput Capacitance		$V_{CE} = 30V$ , $V_{GE} = 0V$ ,		45	-	pF
C <sub>res</sub>	-	ransfer Capacitance	f = 1MHz		-	32	-	pF
Switching	Turn-On D				-	20		ns
t <sub>d(on)</sub>	Rise Time	elay Tille	_		-	245	_	ns
t <sub>r</sub>	Turn-Off D	elav Time	V 600V	1 204		400	-	ns
t <sub>d(off)</sub> t <sub>f</sub>	Fall Time		V <sub>CC</sub> = 600V, R <sub>G</sub> = 10Ω, V		_	130	-	ns
գ E <sub>on</sub>		witching Loss	Resistive Load, $T_C = 25^{\circ}C$		_	0.76	-	mJ
E <sub>off</sub>		witching Loss			-	0.76	-	mJ
E <sub>ts</sub>	Total Swite					1.32	-	mJ
t <sub>d(on)</sub>	Turn-On D	0			-	21	-	ns
t <sub>r</sub>	Rise Time	,	-		-	301	-	ns
t <sub>d(off)</sub>	Turn-Off D	elay Time	$V_{00} = 600V$	$l_{c} = 20A$	-	420	-	ns
t <sub>f</sub>	Fall Time		$\frac{V_{CC} = 600V, I_C = 20A,}{R_G = 10\Omega, V_{GE} = 15V,}$ Resistive Load, T <sub>C</sub> = 175°C		-	356	-	ns
E <sub>on</sub>		witching Loss			-	0.95	-	mJ
E <sub>off</sub>		witching Loss			-	1.39	-	mJ
E <sub>ts</sub>	Total Swite	0	-		-	2.34	-	mJ
Q <sub>g</sub>	Total Gate				-	203.5	-	nC
Q <sub>ge</sub>		nitter Charge	$V_{CE} = 600V,$	I <sub>C</sub> = 20A,	-	10.8	-	nC
Q <sub>gc</sub>	Gate to Co	ollector Charge	V <sub>GE</sub> = 15V		-	84.6	-	nC





**Figure 4. Transfer Characteristics** 

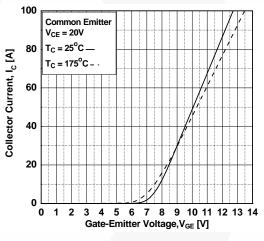
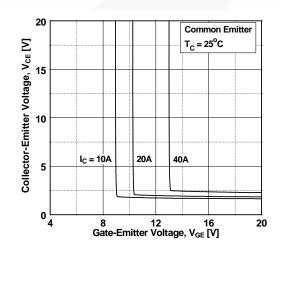
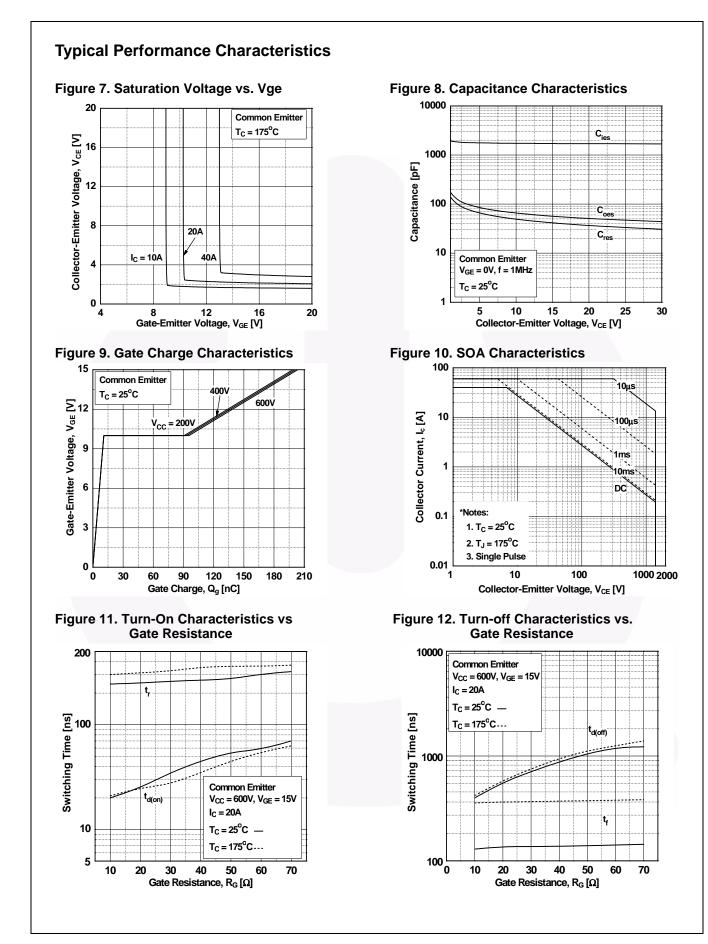


Figure 6. Saturation Voltage vs. Vge



FGA20S140P — 1400 V, 20 A Shorted-anode IGBT



t<sub>d(off)</sub>

40

40

30

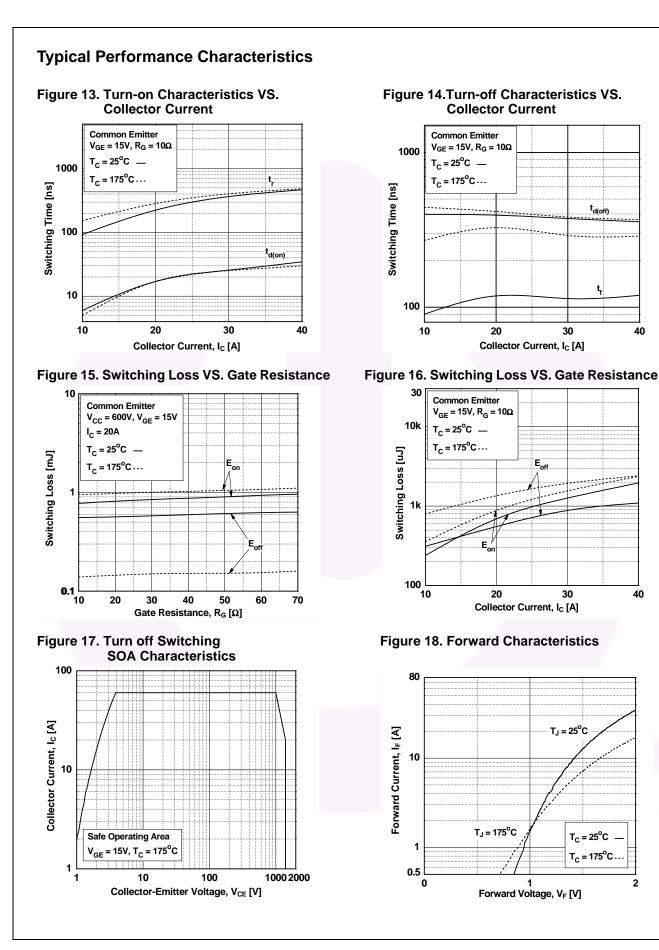
E<sub>off</sub>

30

T<sub>J</sub> = 25<sup>o</sup>C

T<sub>C</sub> = 25°C

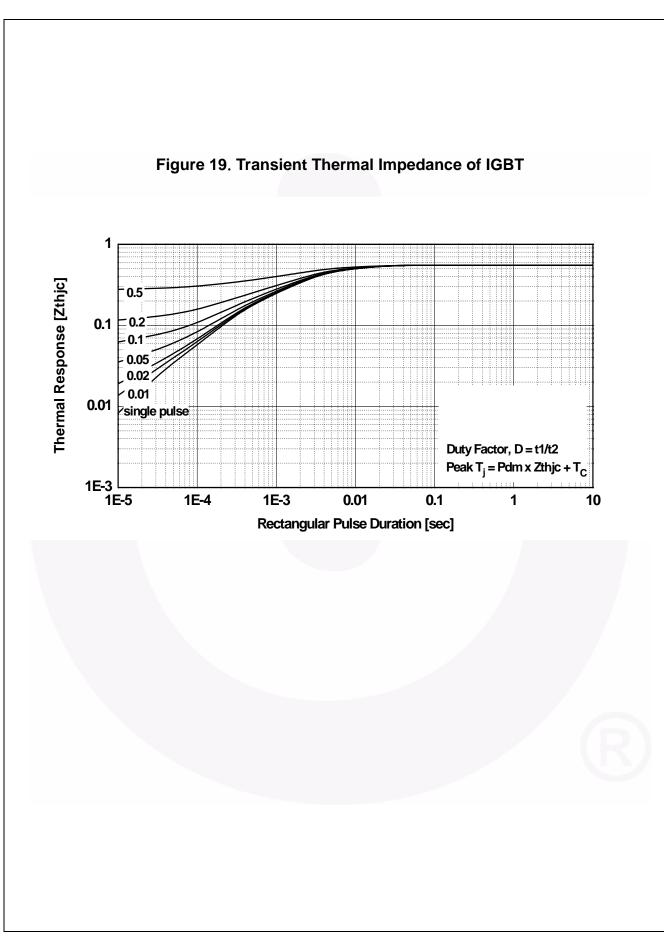
T<sub>C</sub> = 175°C...

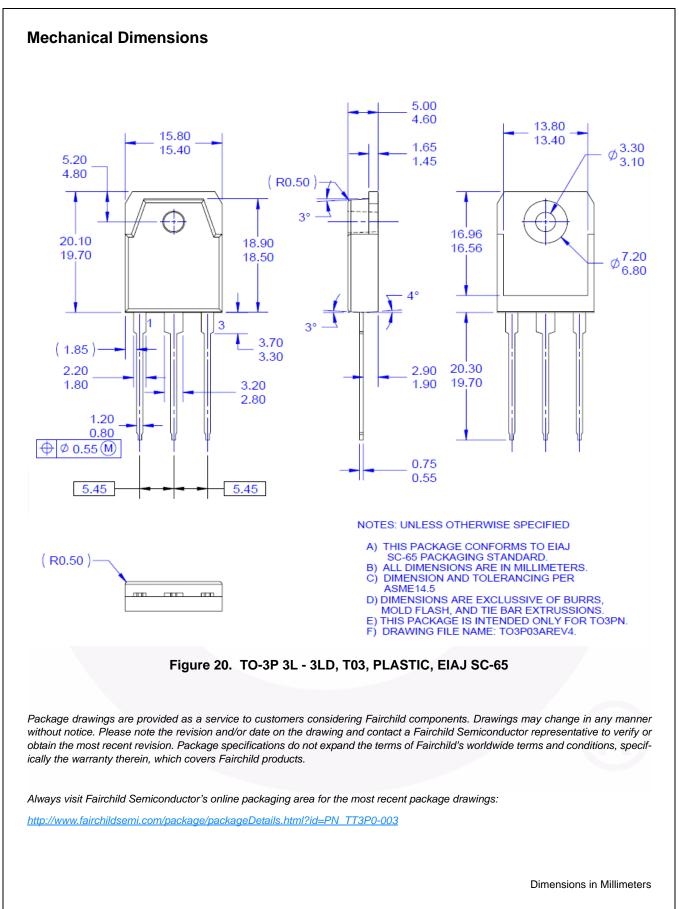


www.fairchildsemi.com

2

©2012 Fairchild Semiconductor Corporation FGA20S140P Rev. C4





©2012 Fairchild Semiconductor Corporation FGA20S140P Rev. C4



SEMICONDUCTOR

#### 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™ AX-CAF BitSiC™ Build it Now™ CorePLUS™ CorePOWER™ CROSSVOLT™ CTL™ Current Transfer Logic™ DEUXPEED® Dual Cool™ EcoSPARK<sup>®</sup> EfficentMax™ ESBC™

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

FRFET® Global Power Resource<sup>SM</sup> GreenBridge™ Green FPS™ Green FPS™ e-Series™ G*max*™ GTO™ IntelliMAX™ ISOPLANAR™ Marking Small Speakers Sound Louder and Better™ MegaBuck™ MICROCOUPLER™ MicroFET<sup>™</sup> MicroPak™ MicroPak2™ MillerDrive™ MotionMax<sup>™</sup> mWSaver<sup>®</sup> OptoHiT™ **OPTOLOGIC<sup>®</sup> OPTOPLANAR<sup>®</sup>** 

F-PES™

PowerTrench<sup>®</sup> PowerXS™ Programmable Active Droop™ **QFĔT**® QS™ Quiet Series™ RapidConfigure™ тм Saving our world, 1mW/W/kW at a time™ SignalWise™ SmartMax™ SMART START™ Solutions for Your Success™ SPM<sup>®</sup> STEALTH™ SuperFET<sup>®</sup> SuperSOT™-3 SuperSOT™-6 SuperSOT™-8 SupreMOS® SyncFET™

Sync-Lock™ **SYSTEM**®' TinyBoost TinyBuck<sup>®</sup> TinyCalc™ TinyLogic® TINYOPTO™ TinyPower™ TinyPWM™ TinyWire™ TranSiC™ TriFault Detect™ TRUECURRENT®\* µSerDes™  $\mathcal{M}_{Ser}$ UHC®

Ultra FRFET™ UniFET™ VCX™ VisualMax™ VoltagePlus™ XS™

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

#### DISCLAIMER

R

FACT®

FAST®

FPS™

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. 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:

- Life support devices or systems are devices or systems which, (a) are 1. 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.
- 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 manufactures 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 handing 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. Specification may change in any manner without notice.		
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a late date. Fairchild Semiconductor reserves the right to make changes at any time with notice to improve design.		
No Identification Needed Full Production		Datasheet contains final specifications. Fairchild Semiconductor reserves the right t 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.		

©2012 Fairchild Semiconductor Corporation FGA20S140P Rev. C4

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 <u>www.onsemi.com/site/pdf/Patent-Marking.pdf</u>. 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 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 has against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death ass

#### 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

© Semiconductor Components Industries, LLC

### **Mouser Electronics**

Authorized Distributor

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

ON Semiconductor: FGA20S140P