

March 2015

600 V, 20 A Field Stop IGBT

FAIRCHILD

Features

- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 2.2 V @ I_C = 20 A
- High Input Impedance
- Fast Switching : E_{OFF} = 8 uJ/A

FGB20N60SFD

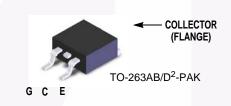
RoHS Compliant

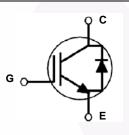
Applications

• Solar Inverter, UPS, Welder, PFC

General Description

Using novel field stop IGBT technology, Fairchild's field stop IGBTs offer the optimum performance for solar inverter, UPS, welder and PFC applications where low conduction and switching losses are essential.





Absolute Maximum Ratings

Symbol	Description	l	Ratings	Unit
V _{CES}	Collector to Emitter Voltage		600	V
14	Gate to Emitter Voltage		±20	V
V _{GES} Transient Gate-to-Emitter Voltage		±30	V	
I _C	Collector Current	@ T _C = 25°C	40	A
·U	Collector Current	@ T _C = 100 ^o C	20	A
I _{CM (1)}	Pulsed Collector Current	@ T _C = 25°C	60	A
IF	Diode Forward Current	@ T _C = 25°C	20	A
'F	Diode Forward Current	@ T _C = 100°C	10	A
I _{FM(1)}	M(1) Pulsed Diode Maximum Forward Current		60	A
PD	Maximum Power Dissipation	@ T _C = 25°C	208	W
. D	Maximum Power Dissipation	@ T _C = 100 ^o C	83	W
TJ	Operating Junction Temperature		-55 to +150	°C
T _{stg}	Storage Temperature Range		-55 to +150	°C
Τ _L	Maximum Lead Temp, for soldering		300	°C

Notes:

1: Repetitive rating: Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Тур.	Max.	Unit
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case	-	0.6	°C/W
R _{0JC} (Diode) Thermal Resistance, Junction to Case		-	2.6	°C/W
$R_{ extsf{ heta}JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)	-	40	°C/W

Notes: 2: Mounted on 1" square PCB (FR4 or G-10 material)

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGB20N60SFD	FGB20N60SFD	D ² -PAK	Reel	13" Dia	N/A	800

Electrical Characteristics of the IGBT T_C = 25°C unless otherwise noted

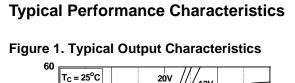
Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Charac	teristics					
BV _{CES}	Collector to Emitter Breakdown Voltage	V _{GE} = 0 V, I _C = 250 μA	600	-	-	V
ΔBV _{CES} / ΔT _J	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0 V, I_C = 250 \mu A$	-	0.6	-	V/ºC
ICES	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0 V$	-	-	250	μA
I _{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0 V$	-	-	±400	nA
On Charac	teristics					
V _{GE(th)}	G-E Threshold Voltage	I _C = 250 μA, V _{CE} = V _{GE}	4.0	5.0	6.5	V
		$I_{\rm C} = 20$ A, $V_{\rm GE} = 15$ V	-	2.2	2.8	V
V _{CE(sat)} Collector to Emitter Saturation	Collector to Emitter Saturation Voltage	$I_{C} = 20 \text{ A}, V_{GE} = 15 \text{ V},$ $T_{C} = 125^{\circ}\text{C}$	-	2.4	-	V
Dynamic C	haracteristics		ł		<u> </u>	
C _{ies}	Input Capacitance		-	940	-	pF
C _{oes}	Output Capacitance	V _{CE} = 30 V _, V _{GE} = 0 V, f = 1 MHz	-	110	-	pF
C _{res}	Reverse Transfer Capacitance		-	40	-	pF
Switching	Characteristics					
t _{d(on)}	Turn-On Delay Time		-	13	-	ns
t _r	Rise Time		-	16	-	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400 V, I _C = 20 A,	-	90	-	ns
t _f	Fall Time	$R_{G} = 10 \Omega$, $V_{GE} = 15 V$,	-	24	48	ns
Eon	Turn-On Switching Loss	Inductive Load, T _C = 25°C	-	0.37	- (mJ
E _{off}	Turn-Off Switching Loss	-	-	0.16	-	mJ
E _{ts}	Total Switching Loss		-	0.53	-	mJ
t _{d(on)}	Turn-On Delay Time		-	12	-	ns
t _r	Rise Time		-	16	-	ns
t _{d(off)}	Turn-Off Delay Time	V _{CC} = 400 V, I _C = 20 A,	-	95	-	ns
t _f	Fall Time	$R_{G} = 10 \Omega$, $V_{GE} = 15 V$,	-	28	-	ns
Eon	Turn-On Switching Loss	Inductive Load, T _C = 125 ^o C	-	0.4	-	mJ
E _{off}	Turn-Off Switching Loss		-	0.28	-	mJ
E _{ts}	Total Switching Loss	1	-	0.69	-	mJ

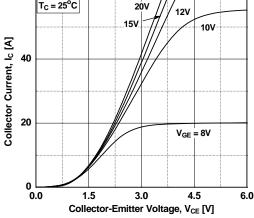
Electrical Characteristics of the IGBT $T_{C} = 25^{\circ}C$ unless otherwise noted

Qg	Total Gate Charge		-	65	-	nC
Q _{ge}	Gate to Emitter Charge	V _{CE} = 400 V, I _C = 20 A, V _{GE} = 15 V	-	7	-	nC
Q _{gc}	Gate to Collector Charge		-	33	-	nC

Electrical Characteristics of the Diode $T_{C} = 25^{\circ}C$ unless otherwise noted

Symbol	Parameter		Test Condition	าร	Min.	Тур.	Max	Unit
V _{FM} Diode Forward Voltage	Diode Forward Voltage	I- =	_F = 10 A	$T_{\rm C} = 25^{\rm o}{\rm C}$	-	1.9	2.5	V
	F = 1077	T _C = 125°C	-	1.7	-			
t _{rr}	Diode Reverse Recovery Time			$T_C = 25^{\circ}C$	-	34	-	ns
11		I _F =10 A, di _F /dt = 200 A/μs	0 Δ di-/dt - 200 Δ/us	$T_{C} = 125^{\circ}C$		57	-	
Q _{rr}		i	10 Λ, αιρία – 200 Λ/μ3	$T_{C} = 25^{\circ}C$	-	41	-	nC
				$T_{\rm C} = 125^{\rm o}{\rm C}$	-	96	-	







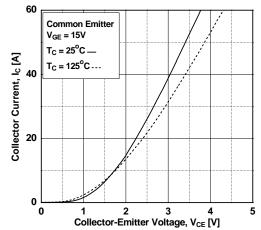


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

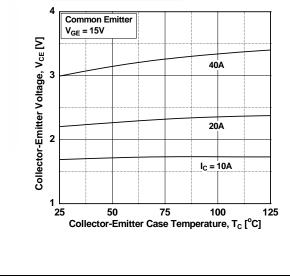


Figure 2. Typical Output Characteristics

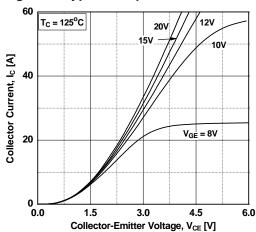


Figure 4. Transfer Characteristics

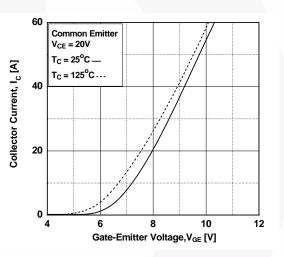
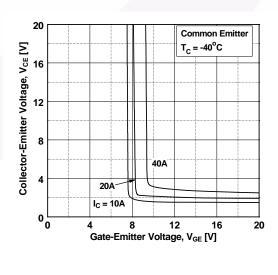
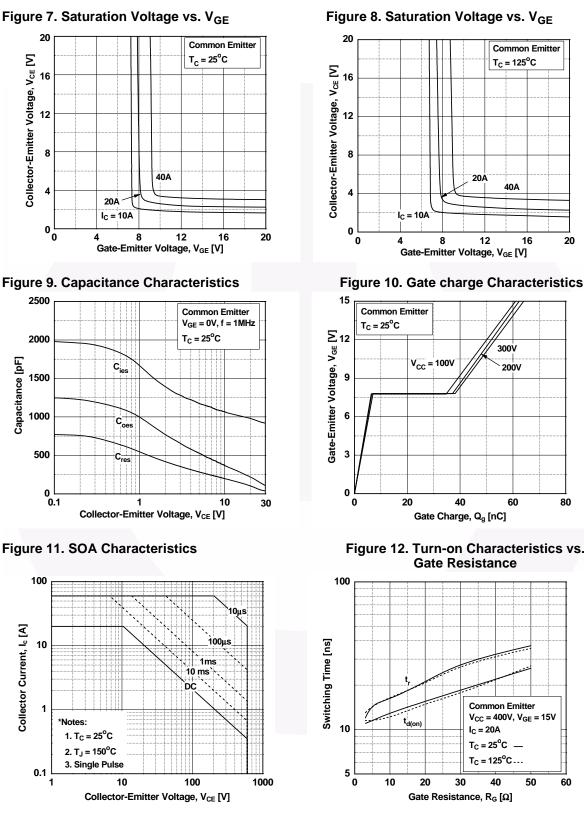


Figure 6. Saturation Voltage vs. V_{GE}





Typical Performance Characteristics

Figure 8. Saturation Voltage vs. V_{GE}

Common Emitter

T_C = 125°C

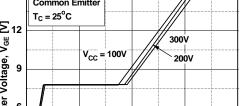
40A

16

20

20Å

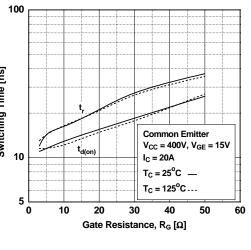
12



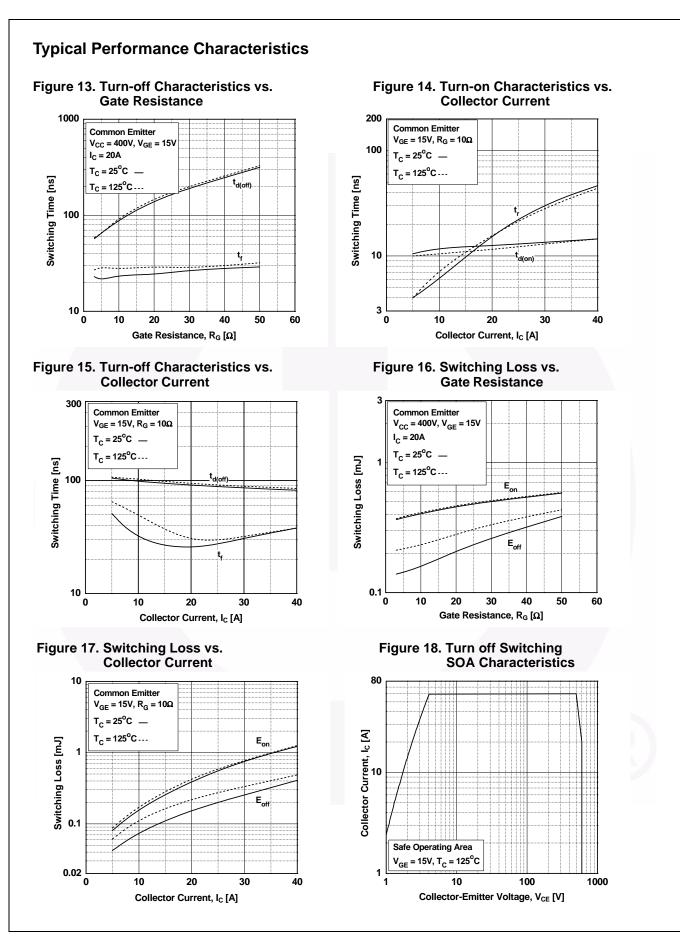
8

40 60 80 Gate Charge, Qg [nC]

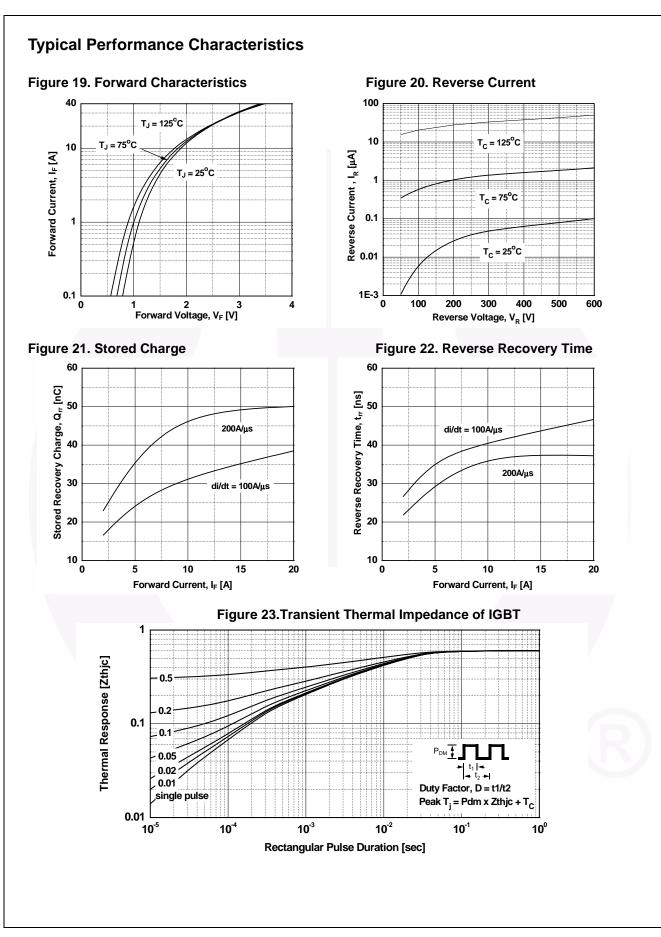
Figure 12. Turn-on Characteristics vs. **Gate Resistance**

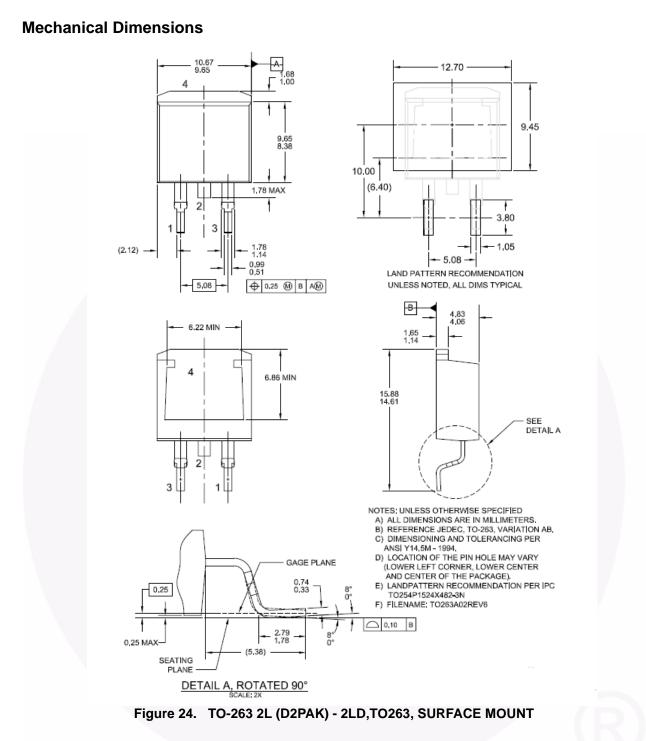


©2011 Fairchild Semiconductor Corporation FGB20N60SFD Rev. 1.6



©2011 Fairchild Semiconductor Corporation FGB20N60SFD Rev. 1.6





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_TT263-002





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 TM AttitudeEngine TM Awinda [®] AX-CAP [®] * BitSiC TM Build it Now TM CorePLUS TM CorePOWER TM CorePOWER TM CORECTION CO	F-PFS [™] FRFET [®] Global Power Resource SM Green Bridge [™] Green FPS [™] e-Series [™] GTO [™] IntelliMAX [™] ISOPLANAR [™] Marking Small Speakers Sound Loude and Better [™] MegaBuck [™] MicroPak [™] MotionGrid [®] MT [®] MT [®] MVN [®] MVN [®] MVN [®] MVN [®] MVN [®] MVN [®] MVN [®] MUSaver [®] OptoHiT [™] OPTOLOGIC [®]	OPTOPLANAR [®] WeverXs TM Programmable Active Droop TM QFET [®] QS TM Quiet Series TM RapidConfigure TM T ^M Saving our world, 1mW/W/kW at a time TM SignalWise TM SignalWise TM SmartMax TM SMART START TM Solutions for Your Success TM SPM [®] STEALTH TM SuperSOT TM -6 SuperSOT TM -6 SuperSOT TM -6 SuperSOT TM -8 SuperSOT	$\label{eq:system} \begin{array}{l} \textcircled{\begin{tabular}{lllllllllllllllllllllllllllllllllll$
---	--	--	---

*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 <u>HTTP://WWW.FAIRCHILDSEMI.COM</u>. 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 2. 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

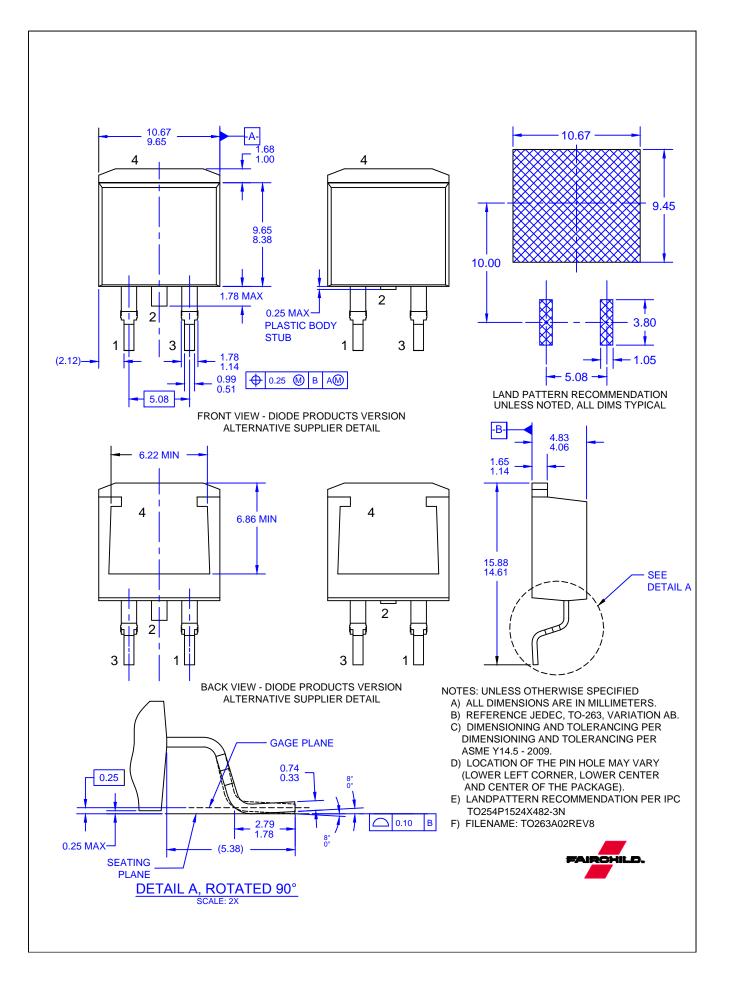
Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support.

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. 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.



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