NGTB40N120L3WG

IGBT − Ultra Field Stop

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Ultra Field Stop Trench construction, and provides superior performance in demanding switching applications, offering both low on−state voltage and minimal switching loss. The IGBT is well suited for motor driver applications. Incorporated into the device is a soft and fast co−packaged free wheeling diode with a low forward voltage.

Features

- Extremely Efficient Trench with Field Stop Technology
- T_{Jmax} = 175°C
- Soft Fast Reverse Recovery Diode
- Optimized for Low V_{CEsat}
- These are Pb−Free Devices

Typical Applications

- Motor Drive Inverter
- Industrial Switching
- Welding

ABSOLUTE MAXIMUM RATINGS

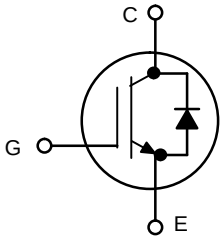
Rating	Symbol	Value	Unit
Collector−emitter voltage	V_{CES}	1200	V
Collector current @ T_C = 25°C @ T_C = 100°C	I_C	 160 40	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	160	A
Diode forward current @ T_C = 25°C @ T_C = 100°C	I_F	 160 40	A
Diode pulsed current, T_{pulse} limited by T_{Jmax}	I_{FM}	160	A
Gate−emitter voltage Transient gate−emitter voltage (t_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 ±30	V
Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 454 227	W
Operating junction temperature range	T_J	−55 to +175	°C
Storage temperature range	T_{stg}	−55 to +175	°C
Lead temperature for soldering, 1/8″ from case for 5 seconds	T_{SLD}	260	°C

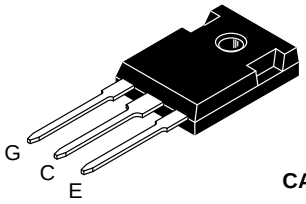
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ON Semiconductor®

www.onsemi.com

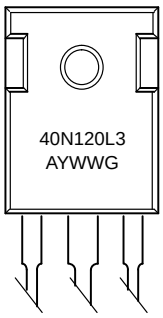
40 A, 1200 V
V_{CEsat} = 1.55 V
E_{off} = 1.5 mJ





TO−247
CASE 340AL

MARKING DIAGRAM



A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping
NGTB40N120L3WG	TO−247 (Pb−Free)	30 Units / Rail

© Semiconductor Components Industries, LLC, 2016

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.33	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	0.61	°C/W
Thermal resistance junction−to−ambient	$R_{\theta JA}$	40	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
STATIC CHARACTERISTIC						
Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 500 μA	$V_{(BR)CES}$	1200	−	−	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 40 A V_{GE} = 15 V, I_C = 40 A, T_J = 175°C	V_{CEsat}	− −	1.55 2.0	1.8 −	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 400 μA	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 1200 V V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 175°C	I_{CES}	− −	− 0.5	0.4	mA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	−	−	200	nA
Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	−	4912	−	pF
Output capacitance		C_{oes}	−	140	−	
Reverse transfer capacitance		C_{res}	−	80	−	
Gate charge total	V_{CE} = 600 V, I_C = 40 A, V_{GE} = 15 V	Q_g	−	220	−	nC
Gate to emitter charge		Q_{ge}	−	42	−	
Gate to collector charge		Q_{gc}	−	110	−	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 600 V, I_C = 40 A R_g = 10 Ω V_{GE} = 15 V	$t_{d(on)}$	−	18	−	ns
Rise time		t_r	−	30	−	
Turn−off delay time		$t_{d(off)}$	−	150	−	
Fall time		t_f	−	131	−	
Turn−on switching loss		E_{on}	−	1.5	−	mJ
Turn−off switching loss		E_{off}	−	1.5	−	
Total switching loss		E_{ts}	−	3.0	−	
Turn−on delay time	T_J = 175°C V_{CC} = 600 V, I_C = 40 A R_g = 10 Ω V_{GE} = 15 V	$t_{d(on)}$	−	18	−	ns
Rise time		t_r	−	31	−	
Turn−off delay time		$t_{d(off)}$	−	156	−	
Fall time		t_f	−	220	−	
Turn−on switching loss		E_{on}	−	2.0	−	mJ
Turn−off switching loss		E_{off}	−	2.3	−	
Total switching loss		E_{ts}	−	4.3	−	
DIODE CHARACTERISTICS						
Forward voltage	V_{GE} = 0 V, I_F = 40 A V_{GE} = 0 V, I_F = 40 A T_J = 175°C	V_F	− −	3.0 2.8	3.4 −	V
Reverse recovery time	T_J = 25°C I_F = 40 A, V_R = 600 V di_F/dt = 500 A/μs	t_{rr}	−	86	−	ns
Reverse recovery charge		Q_{rr}	−	0.56	−	μc
Reverse recovery current		I_{rrm}	−	12	−	A
Diode peak rate of fall of reverse recovery current during tb		dI_{rrm}/dt	−	−210	−	A/μs

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODE CHARACTERISTICS						
Reverse recovery time	T_J = 125°C I_F = 40 A, V_R = 600 V di_F/dt = 500 A/μs	t_{rr}	−	136	−	ns
Reverse recovery charge		Q_{rr}	−	1.47	−	μc
Reverse recovery current		I_{rrm}	−	20	−	A
Diode peak rate of fall of reverse recovery current during tb		dI_{rrm}/dt	−	−212	−	A/μs

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

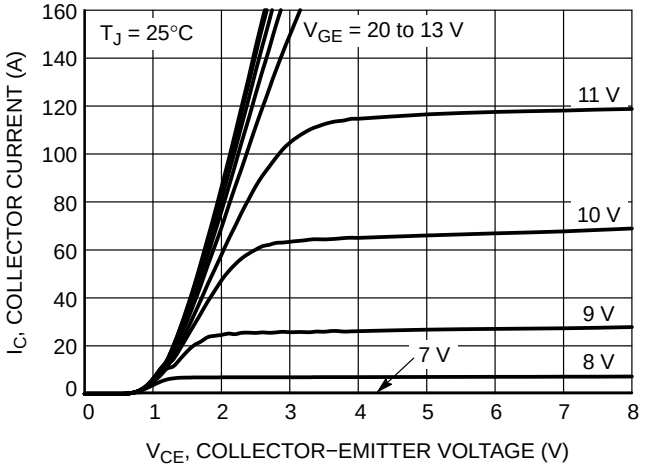


Figure 1. Output Characteristics

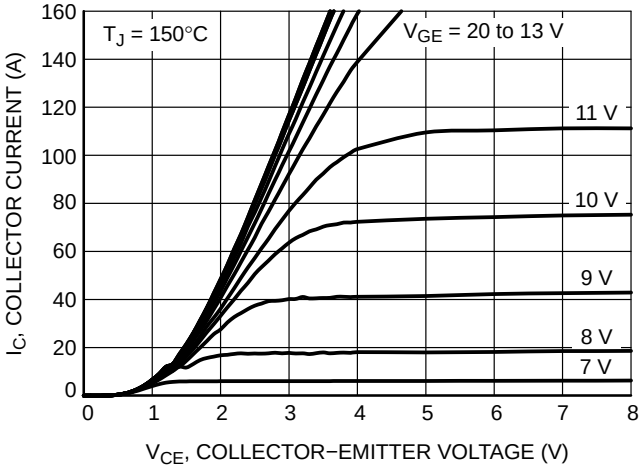


Figure 2. Output Characteristics

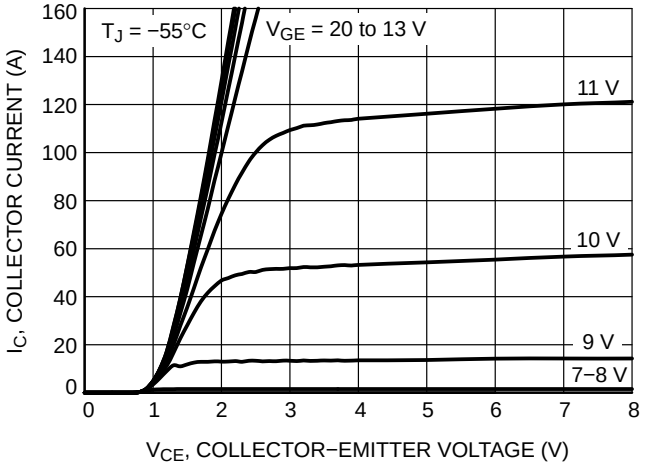


Figure 3. Output Characteristics

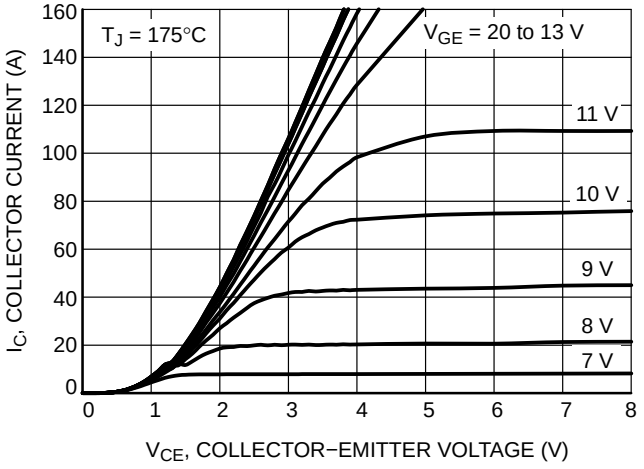


Figure 4. Output Characteristics

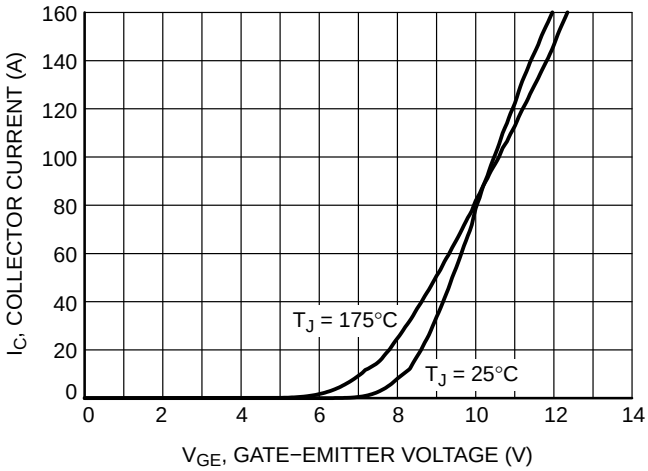


Figure 5. Typical Transfer Characteristics

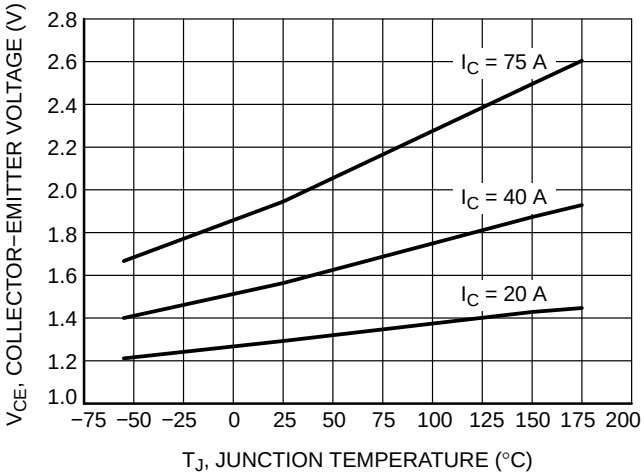


Figure 6. $V_{CE(sat)}$ vs. T_J

TYPICAL CHARACTERISTICS

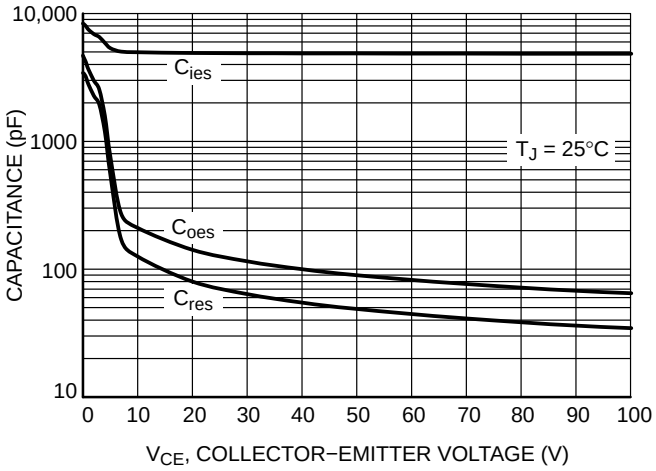


Figure 7. Typical Capacitance

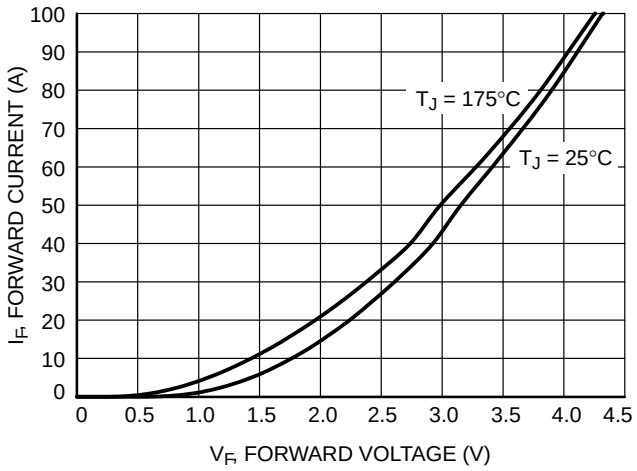


Figure 8. Diode Forward Characteristics

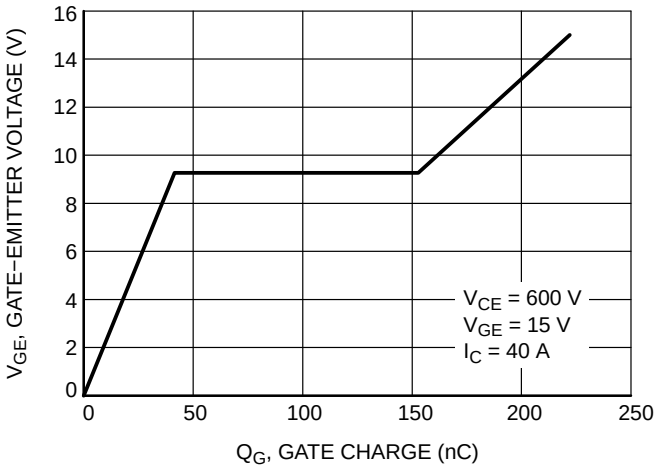


Figure 9. Typical Gate Charge

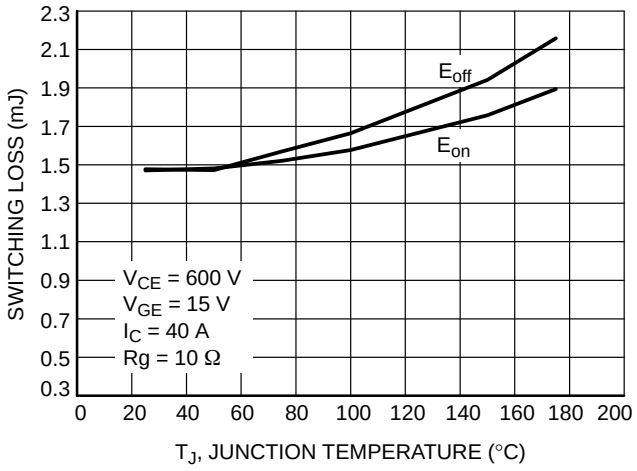


Figure 10. Switching Loss vs. Temperature

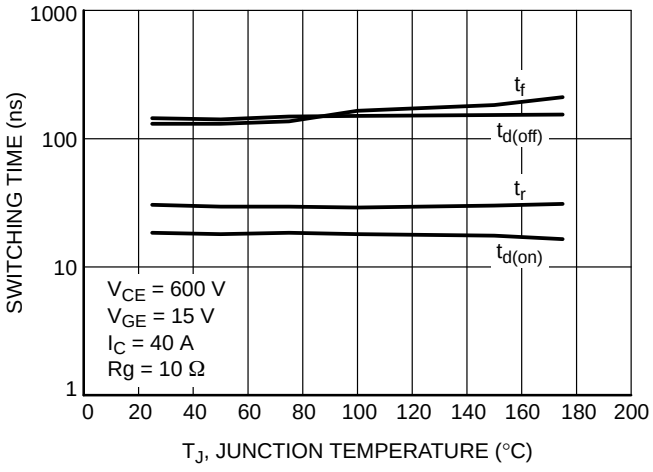


Figure 11. Switching Loss vs. Temperature

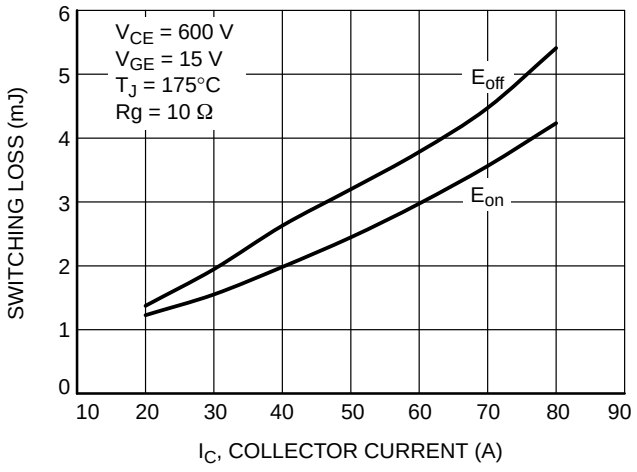


Figure 12. Switching Loss vs. I_C

TYPICAL CHARACTERISTICS

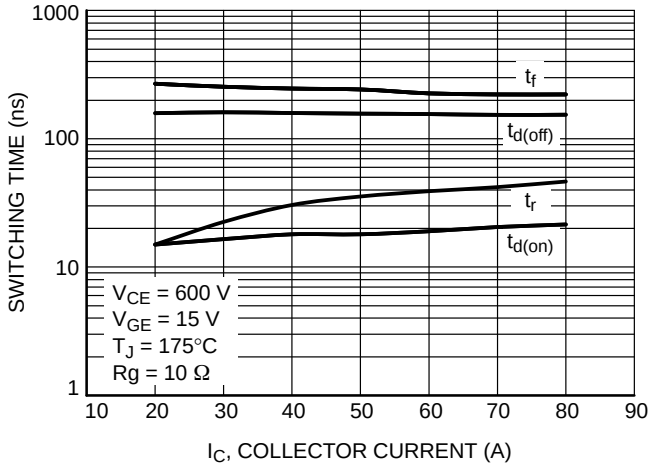


Figure 13. Switching Time vs. I_C

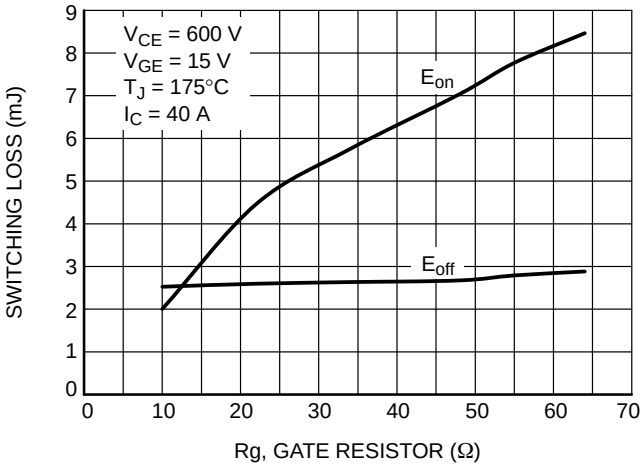


Figure 14. Switching Loss vs. R_G

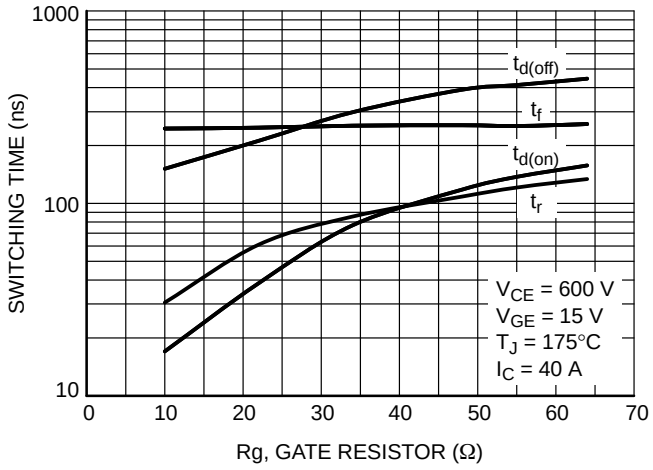


Figure 15. Switching Time vs. R_G

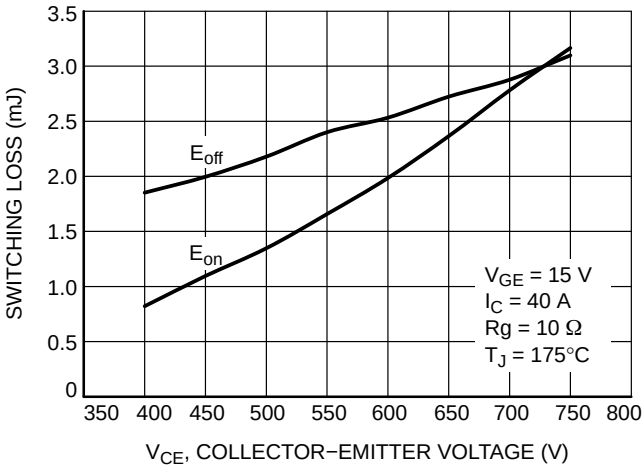


Figure 16. Switching Loss vs. V_{CE}

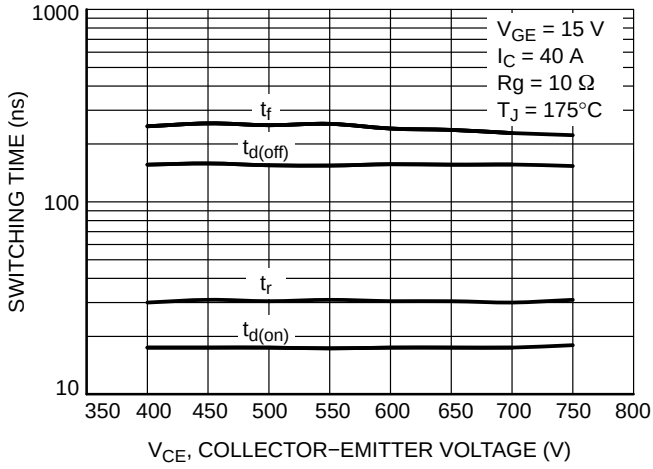


Figure 17. Switching Time vs. V_{CE}

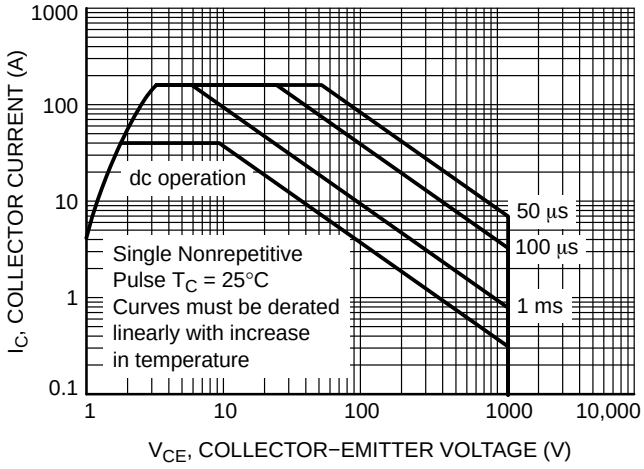


Figure 18. Safe Operating Area

TYPICAL CHARACTERISTICS

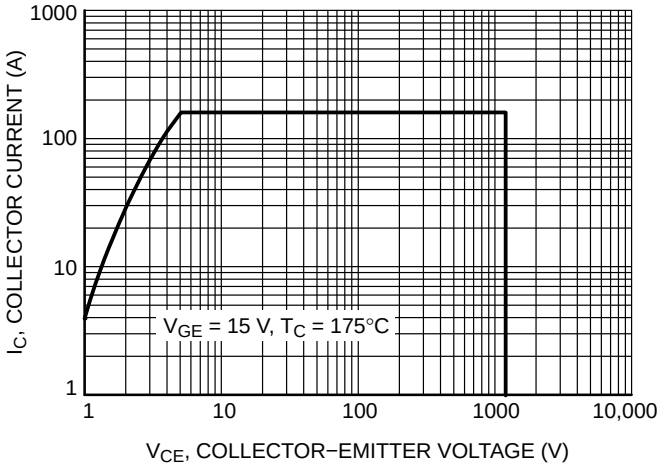


Figure 19. Reverse Bias Safe Operating Area

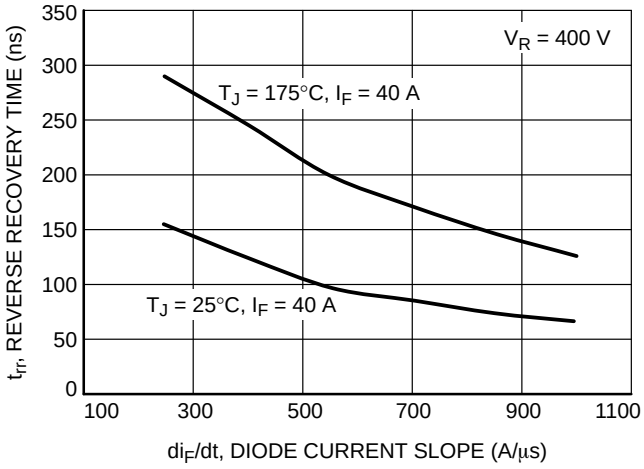


Figure 20. t_{rr} vs. di_F/dt

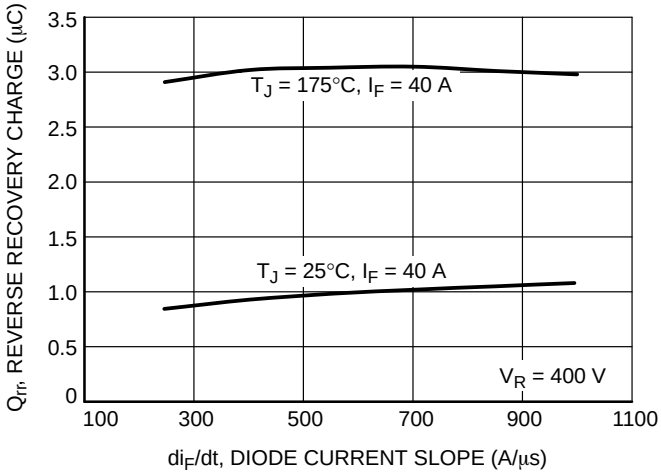


Figure 21. Q_{rr} vs. di_F/dt

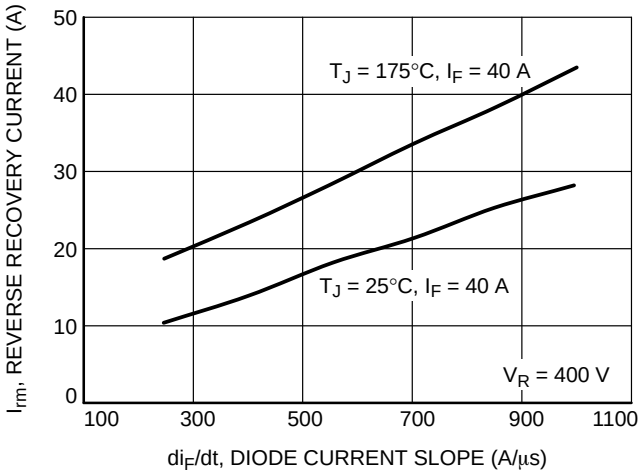


Figure 22. I_{rm} vs. di_F/dt

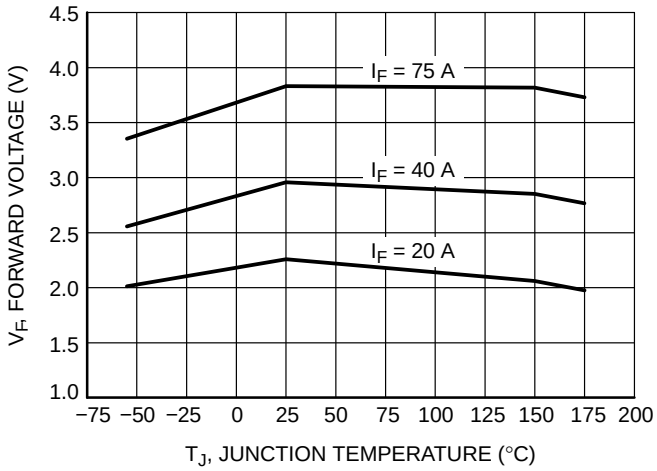


Figure 23. V_F vs. T_J

TYPICAL CHARACTERISTICS

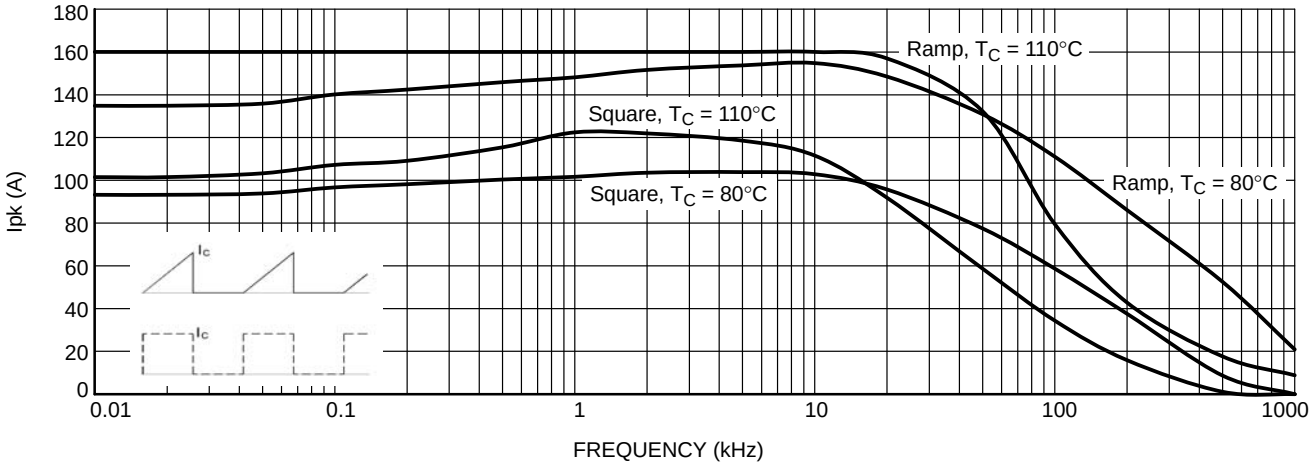


Figure 24. Collector Current vs. Switching Frequency

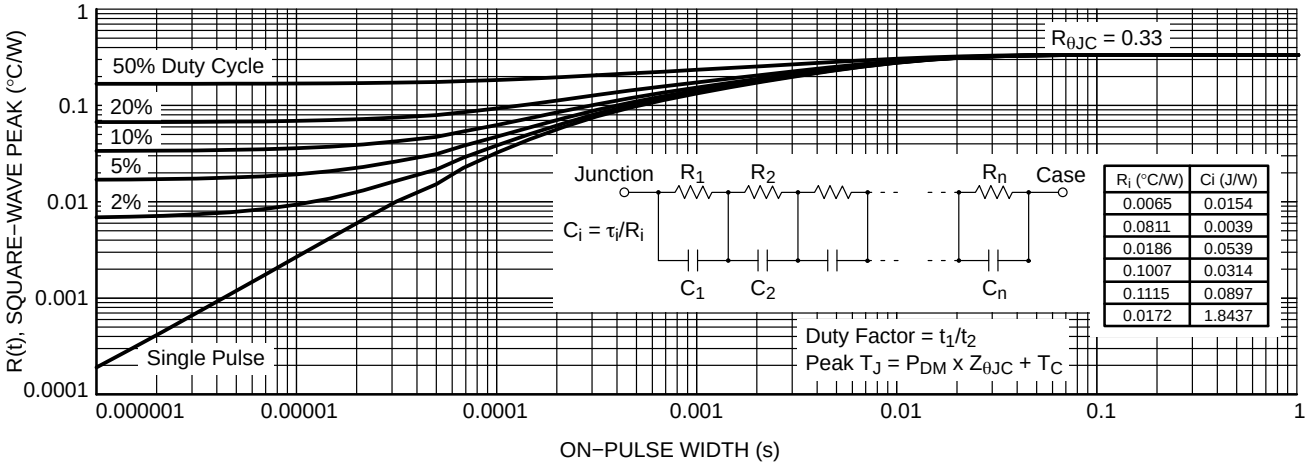


Figure 25. IGBT Transient Thermal Impedance

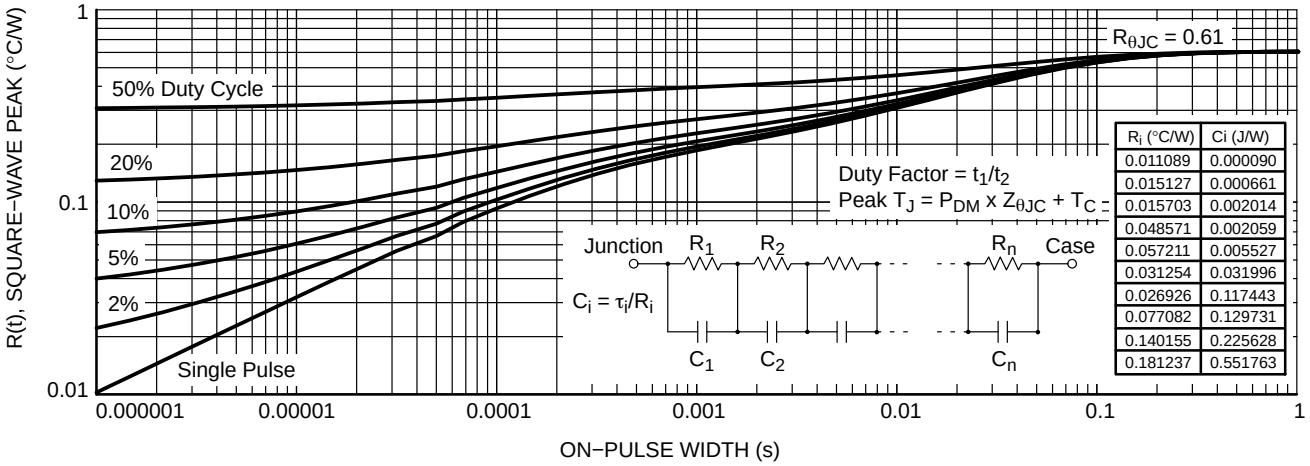


Figure 26. Diode Transient Thermal Impedance

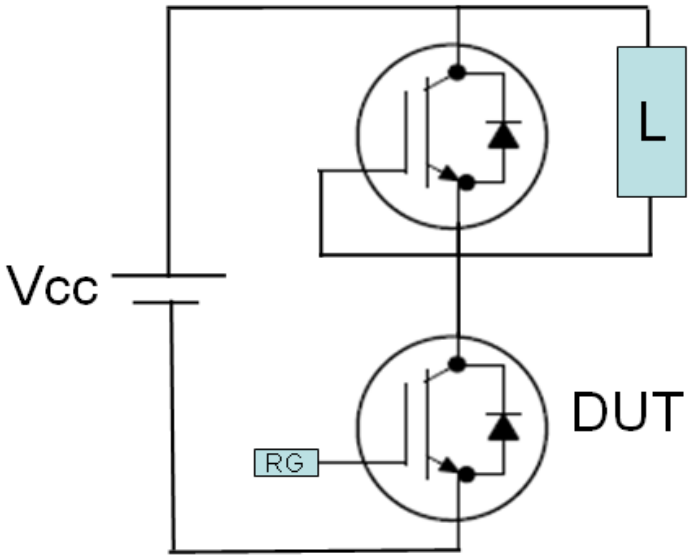


Figure 27. Test Circuit for Switching Characteristics

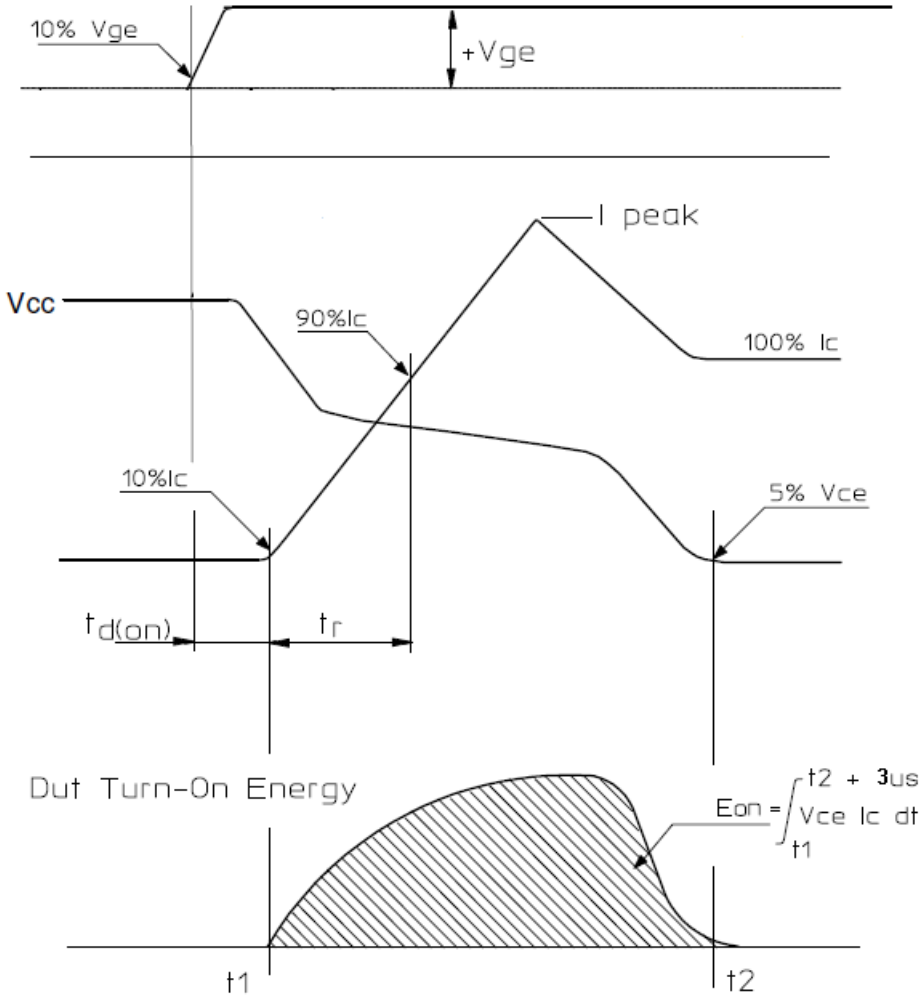


Figure 28. Definition of Turn On Waveform

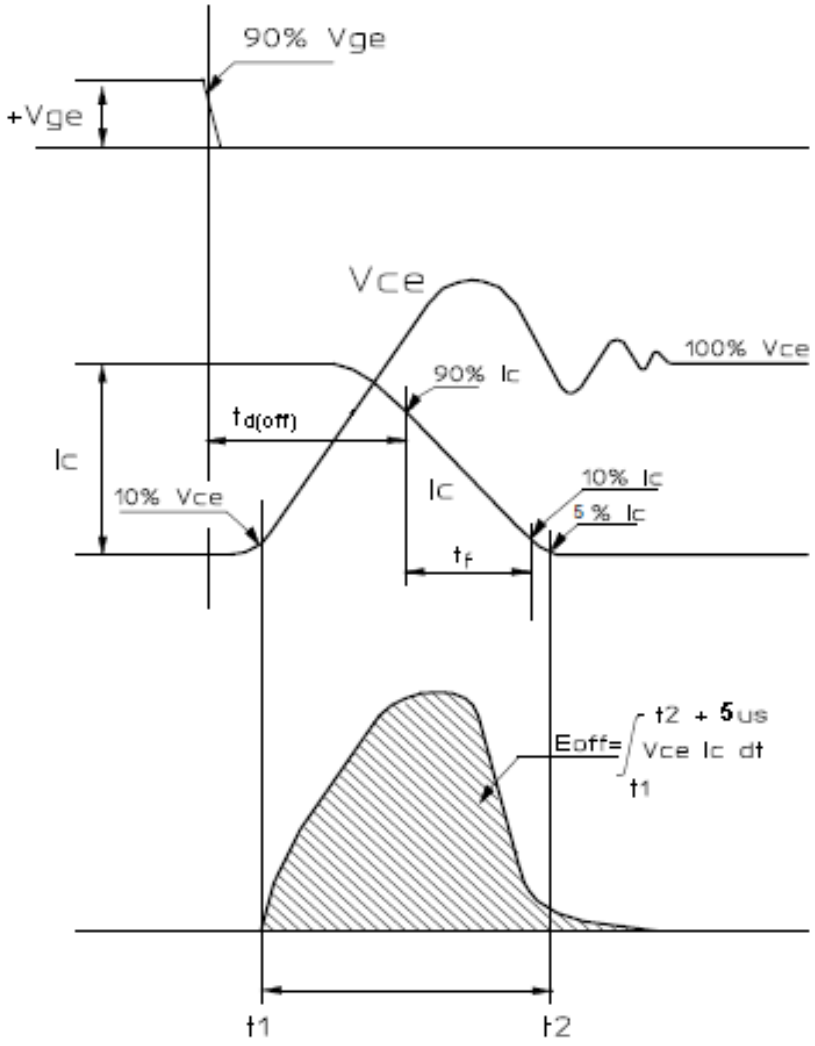
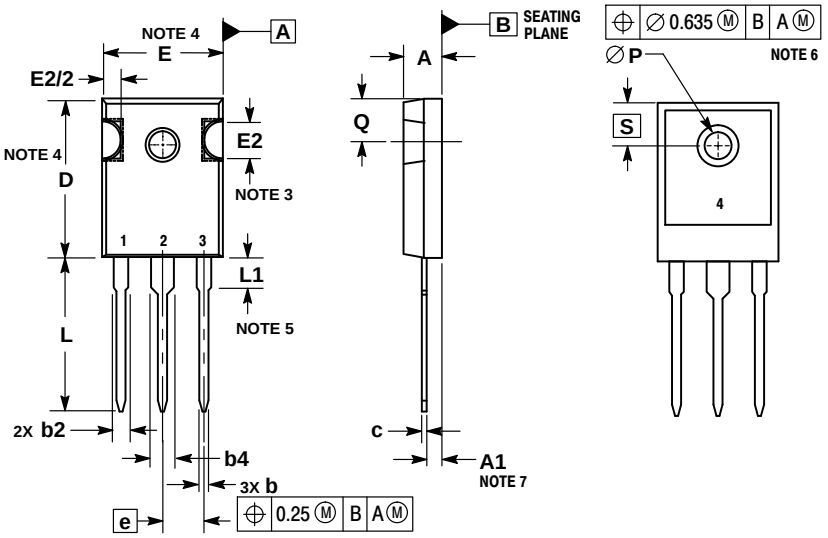


Figure 29. Definition of Turn Off Waveform

NGTB40N120L3WG

PACKAGE DIMENSIONS

TO−247
CASE 340AL
ISSUE B



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. SLOT REQUIRED, NOTCH MAY BE ROUNDED.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.
6. ∅P SHALL HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM DIAMETER OF 3.91.
7. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.

	MILLIMETERS	
DIM	MIN	MAX
A	4.70	5.30
A1	2.20	2.60
b	1.00	1.40
b2	1.65	2.35
b4	2.60	3.40
c	0.40	0.80
D	20.80	21.34
E	15.50	16.25
E2	4.32	5.49
e	5.45 BSC	
L	19.80	20.80
L1	3.81	4.32
P	3.55	3.65
Q	5.40	6.20
S	6.15 BSC	

ON Semiconductor and ON 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

Mouser Electronics

Authorized Distributor

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

ON Semiconductor:

NGTB40N120L3WG