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# NGTB40N120IHLWG

## IGBT

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop (FS) 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 resonant or soft switching applications. Incorporated into the device is a rugged co-packaged free wheeling diode with a low forward voltage.

### Features

- Low Saturation Voltage using Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- Optimized for Low Case Temperature in IH Cooker Application
- Low Gate Charge
- These are Pb-Free Devices

### Typical Applications

- Inductive Heating
- Consumer Appliances
- Soft Switching

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	$V_{CES}$	1200	V
Collector current @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$I_C$	80 40	A
Pulsed collector current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{CM}$	320	A
Diode forward current @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$I_F$	80 40	A
Diode pulsed current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{FM}$	320	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Power Dissipation @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$P_D$	260 104	W
Operating junction temperature range	$T_J$	-55 to +150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Lead temperature for soldering, 1/8" from case for 5 seconds	$T_{SLD}$	260	$^\circ\text{C}$

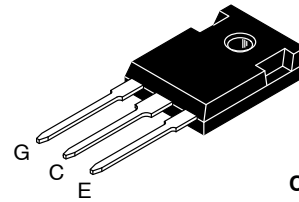
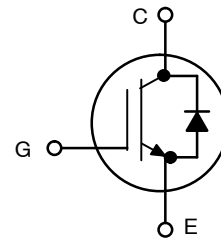
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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**40 A, 1200 V**  
 **$V_{CEsat} = 1.90 \text{ V}$**   
 **$E_{off} = 1.40 \text{ mJ}$**



**TO-247  
CASE 340L  
STYLE 4**

### MARKING DIAGRAM



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

### ORDERING INFORMATION

Device	Package	Shipping
NGTB40N120IHLWG	TO-247 (Pb-Free)	30 Units / Rail

# NGTB40N120IHLWG

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.48	$^{\circ}\text{C}/\text{W}$
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	1.5	$^{\circ}\text{C}/\text{W}$
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^{\circ}\text{C}/\text{W}$

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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### STATIC CHARACTERISTIC

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, I_C = 500\ \mu\text{A}$	$V_{(BR)CES}$	1200	-	-	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 40\text{ A}, T_J = 150^{\circ}\text{C}$	$V_{CEsat}$	-	1.90 2.1	2.35 -	V
Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 400\ \mu\text{A}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$ $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 150^{\circ}\text{C}$	$I_{CES}$	-	-	0.5 2.0	mA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	200	nA

### DYNAMIC CHARACTERISTIC

Input capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{ies}$	-	10400	-	pF
Output capacitance		$C_{oes}$	-	245	-	
Reverse transfer capacitance		$C_{res}$	-	185	-	
Gate charge total	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$		420		nC
Gate to emitter charge		$Q_{ge}$		95		
Gate to collector charge		$Q_{gc}$		178		

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-off delay time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(off)}$		360		ns
Fall time		$t_f$		130		
Turn-off switching loss		$E_{off}$		1.40		
Turn-off delay time	$T_J = 125^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(off)}$		380		ns
Fall time		$t_f$		185		
Turn-off switching loss		$E_{off}$		2.6		

### DIODE CHARACTERISTIC

Forward voltage	$V_{GE} = 0\text{ V}, I_F = 40\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 40\text{ A}, T_J = 150^{\circ}\text{C}$	$V_F$		1.6 1.8	1.8	V
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# NGTB40N120IHLWG

## TYPICAL CHARACTERISTICS

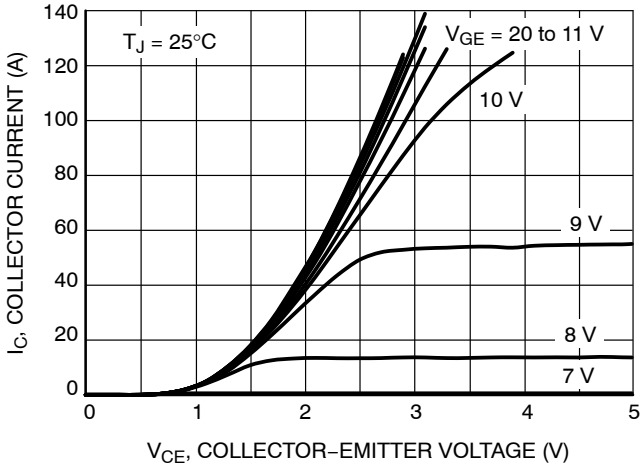


Figure 1. Output Characteristics

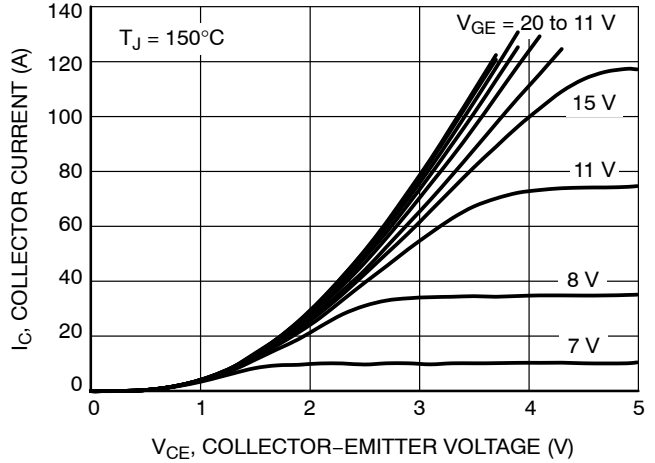


Figure 2. Output Characteristics

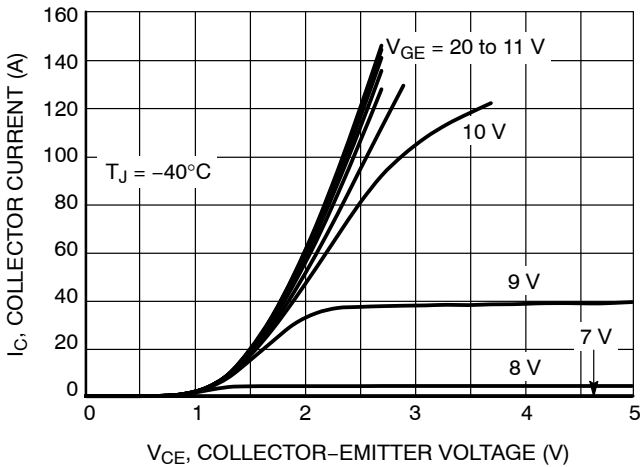


Figure 3. Output Characteristics

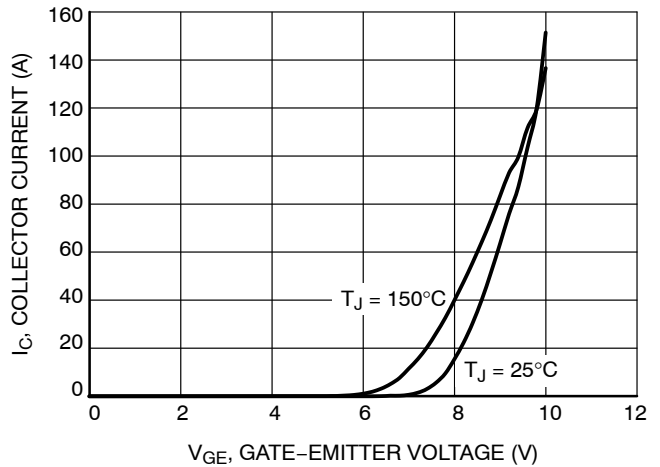


Figure 4. Typical Transfer Characteristics

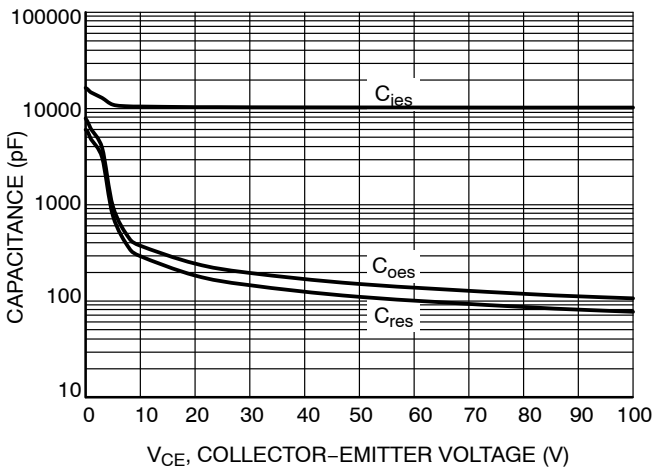


Figure 5. Typical Capacitance

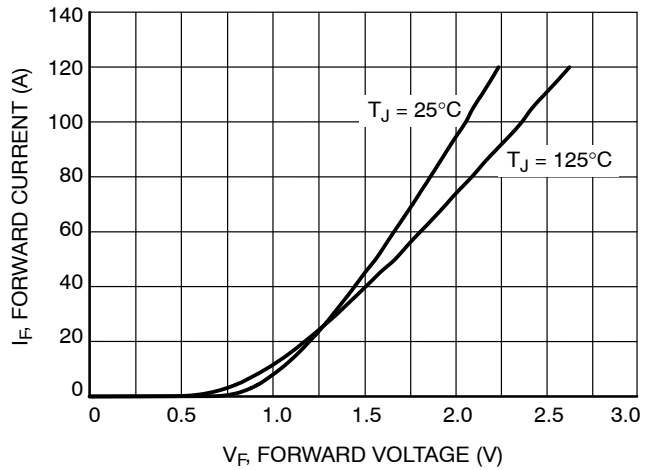


Figure 6. Diode Forward Characteristics

# NGTB40N120IHLWG

## TYPICAL CHARACTERISTICS

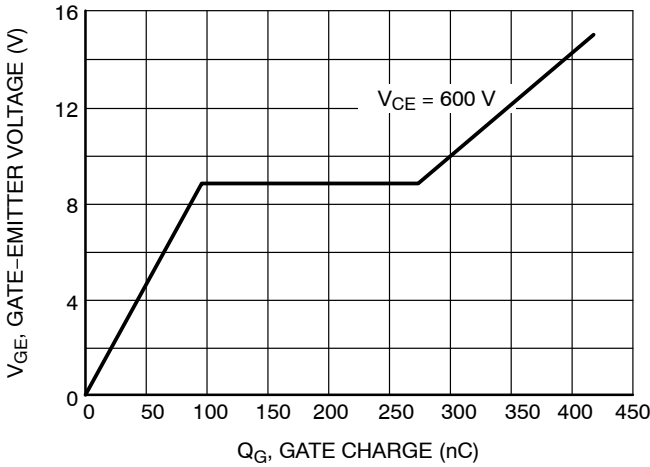


Figure 7. Typical Gate Charge

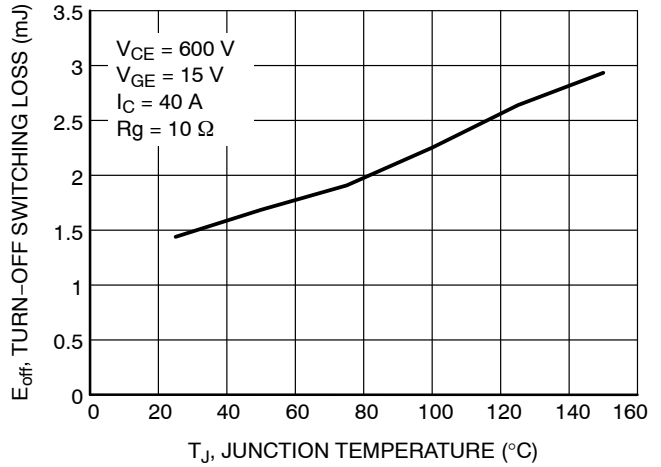


Figure 8. Energy Loss vs. Temperature

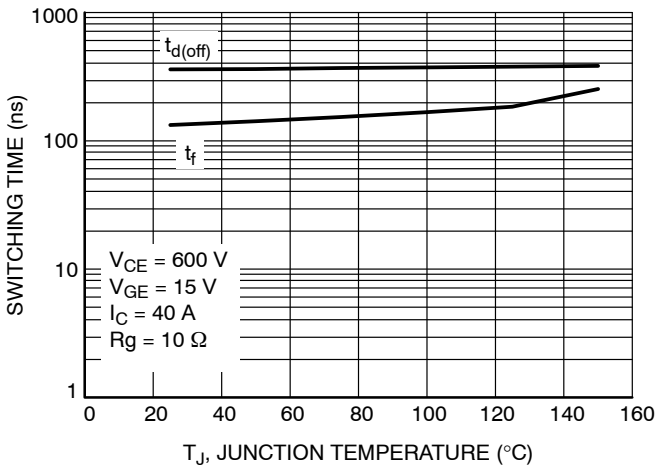


Figure 9. Switching Time vs. Temperature

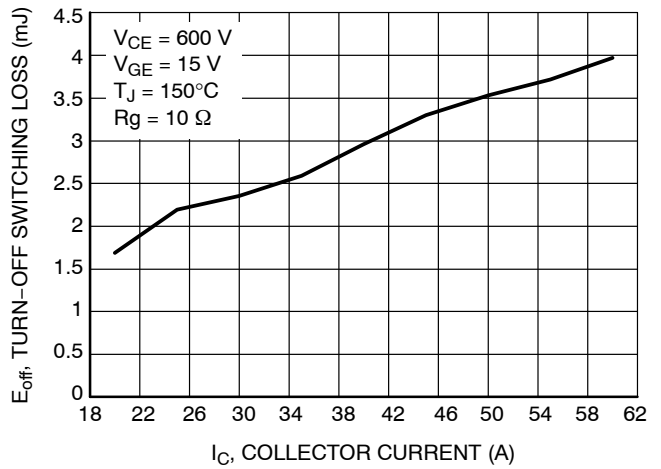


Figure 10. Energy Loss vs.  $I_C$

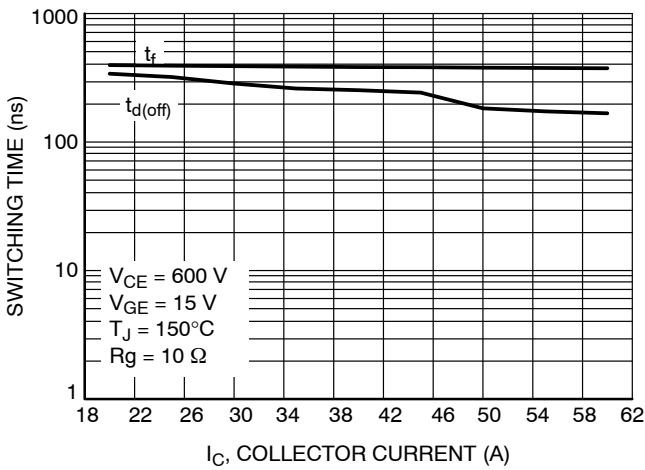


Figure 11. Switching Time vs.  $I_C$

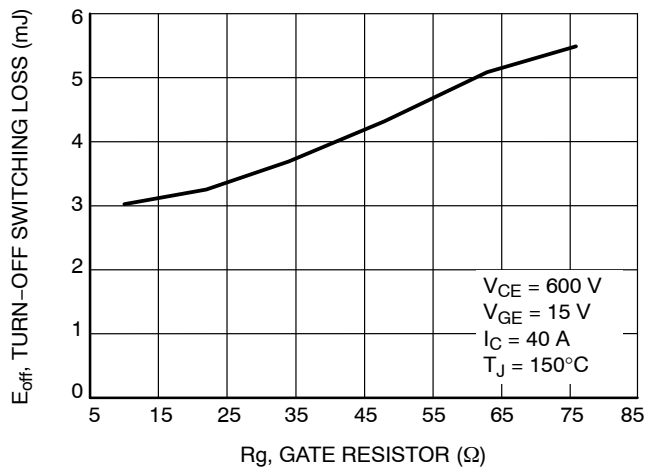


Figure 12. Energy Loss vs.  $R_g$

# NGTB40N120IHLWG

## TYPICAL CHARACTERISTICS

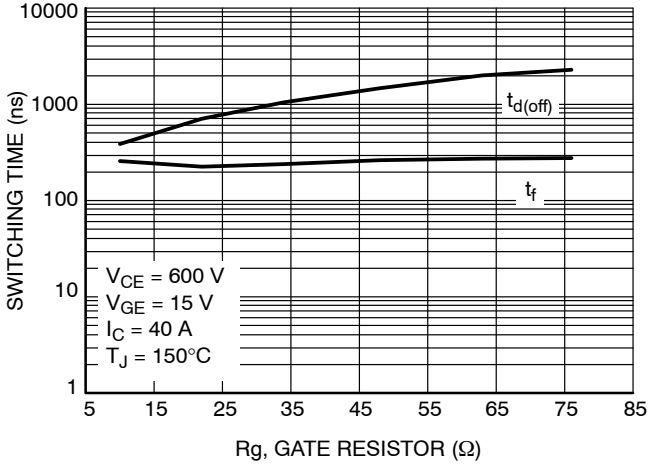


Figure 13. Switching Time vs.  $R_g$

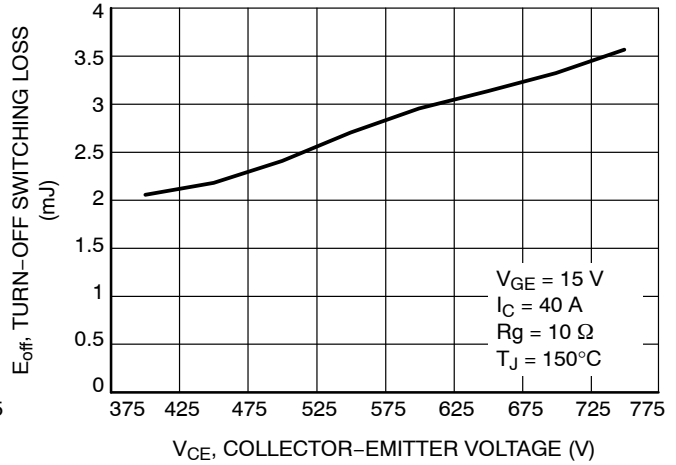


Figure 14. Energy Loss vs.  $V_{CE}$

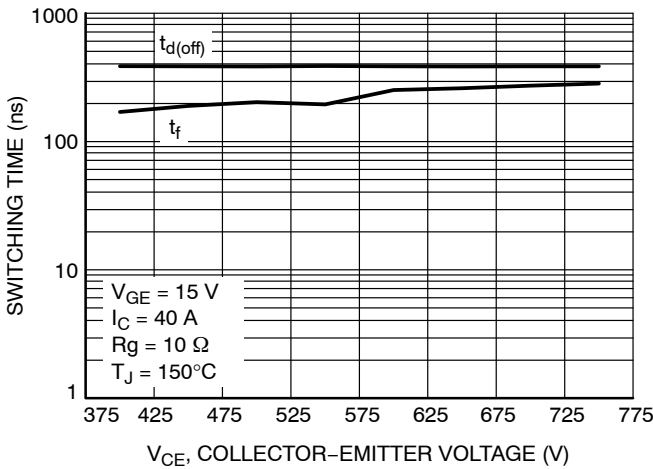


Figure 15. Switching Time vs.  $V_{CE}$

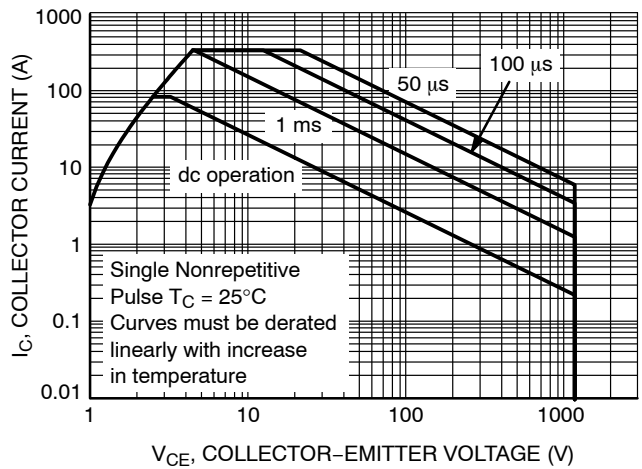


Figure 16. Safe Operating Area

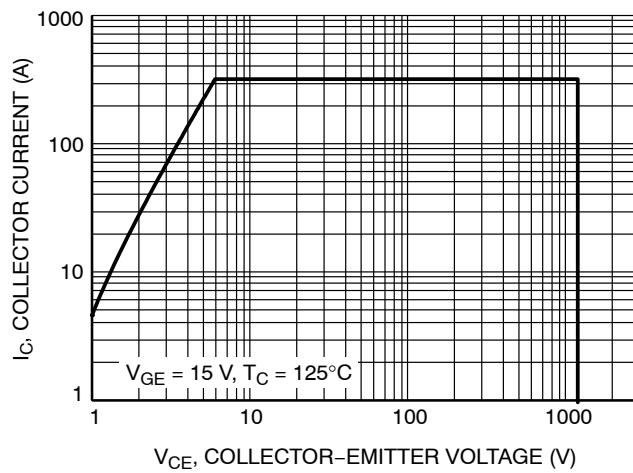


Figure 17. Reverse Bias Safe Operating Area

# NGTB40N120IHLWG

## TYPICAL CHARACTERISTICS

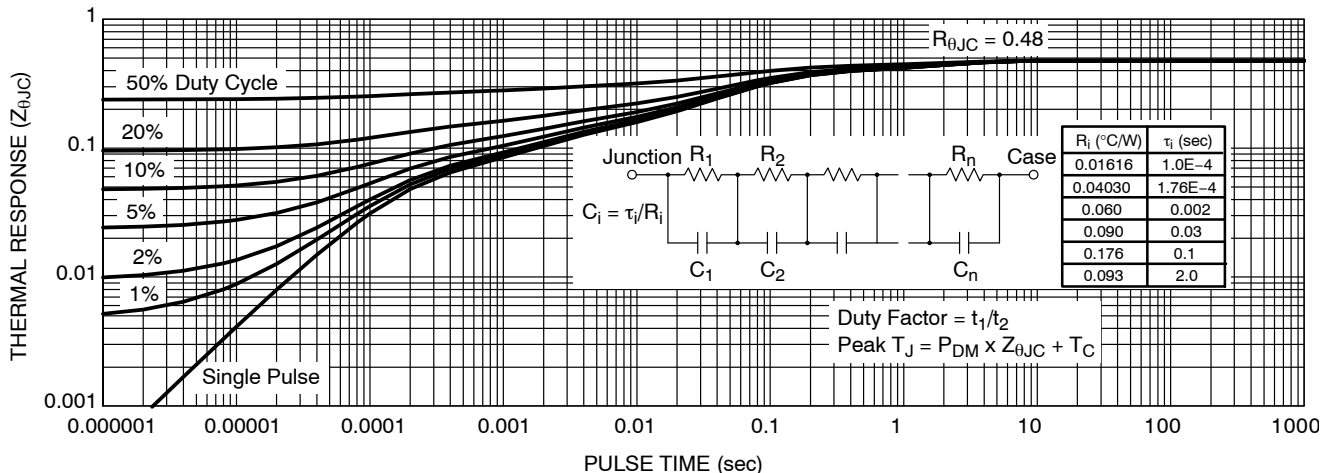


Figure 18. IGBT Transient Thermal Impedance

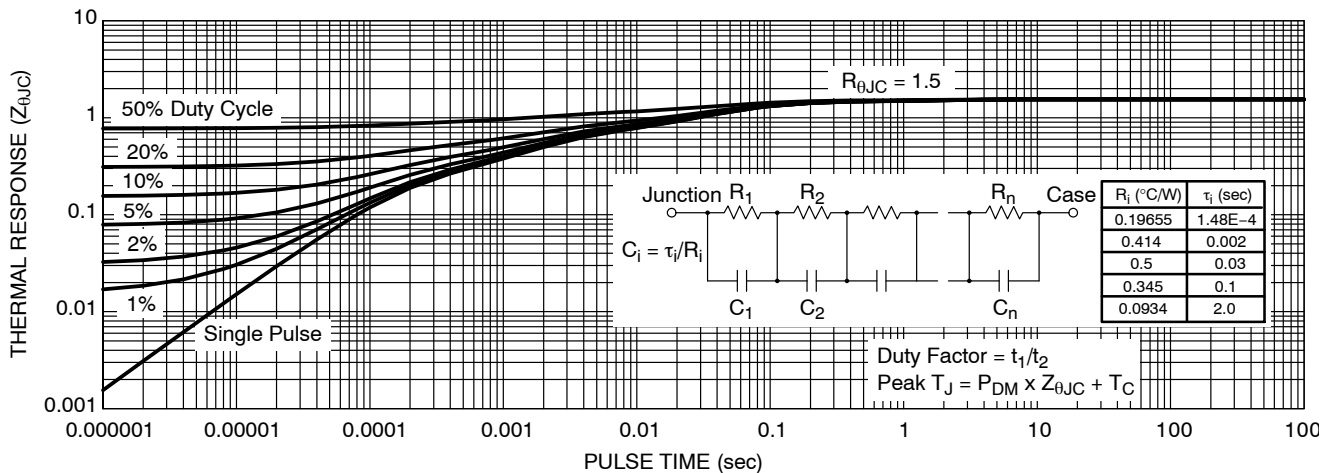


Figure 19. Diode Transient Thermal Impedance

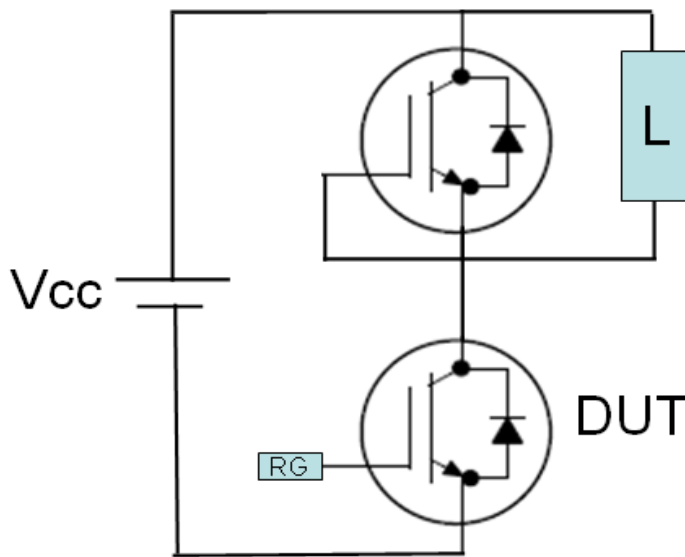


Figure 20. Test Circuit for Switching Characteristics

# NGTB40N120IHLWG

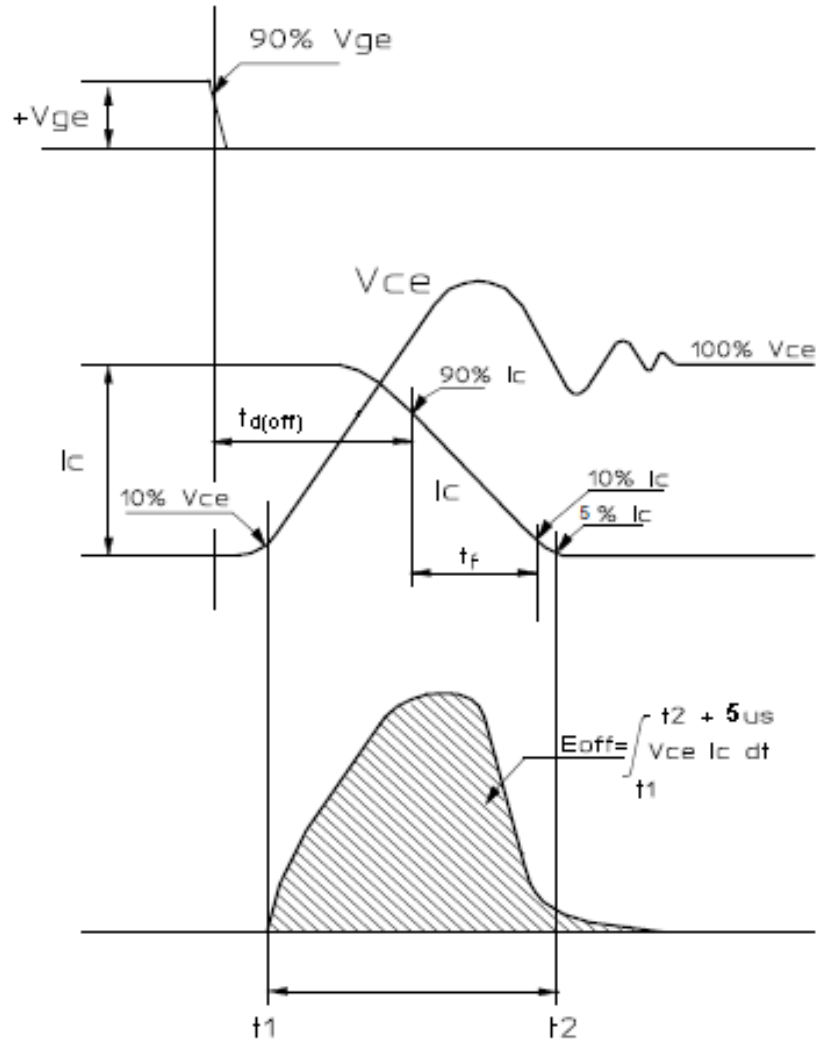
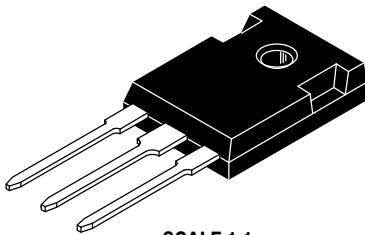


Figure 21. Definition of Turn Off Waveform



# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

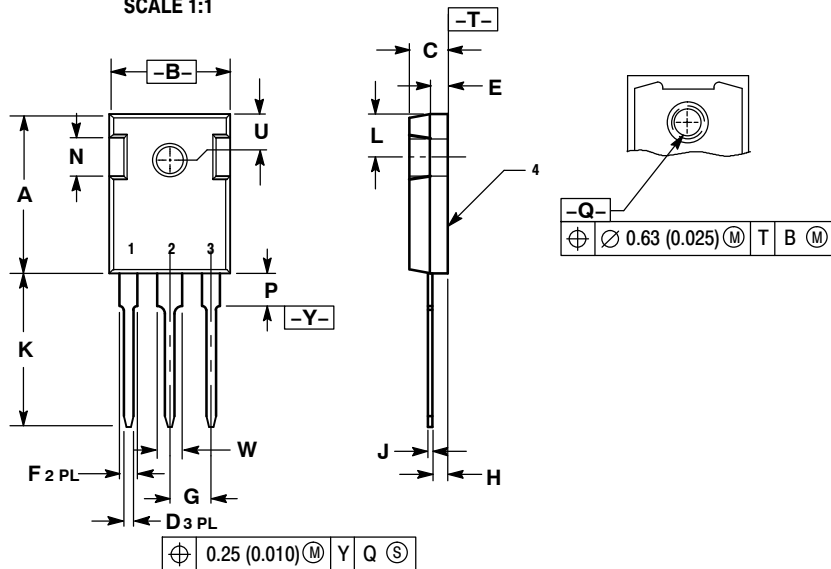
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TO-247  
CASE 340L-02  
ISSUE F

DATE 26 OCT 2011

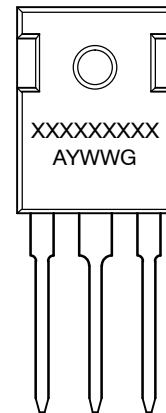
SCALE 1:1



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	1.90	2.60	0.075	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	19.81	20.83	0.780	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

### GENERIC MARKING DIAGRAM\*



XXXXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 G = Pb-Free Package

- STYLE 1:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN
- STYLE 2:  
PIN 1. ANODE  
2. CATHODE (S)  
3. ANODE 2  
4. CATHODES (S)
- STYLE 3:  
PIN 1. BASE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR
- STYLE 4:  
PIN 1. GATE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR
- STYLE 5:  
PIN 1. CATHODE  
2. ANODE  
3. GATE  
4. ANODE
- STYLE 6:  
PIN 1. MAIN TERMINAL 1  
2. MAIN TERMINAL 2  
3. GATE  
4. MAIN TERMINAL 2

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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