

# NGTG40N120FL2WG

## IGBT - Field Stop II

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop II 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 UPS and solar applications.

### Features

- Extremely Efficient Trench with Field Stop Technology
- $T_{Jmax} = 175^{\circ}C$
- Optimized for High Speed Switching
- 10  $\mu s$  Short Circuit Capability
- These are Pb-Free Devices

### Typical Applications

- Solar Inverter
- Uninterruptible Power Inverter Supplies (UPS)
- Welding

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	$V_{CES}$	1200	V
Collector current @ $T_C = 25^{\circ}C$ @ $T_C = 100^{\circ}C$	$I_C$	80 40	A
Pulsed collector current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{CM}$	200	A
Gate-emitter voltage Transient gate-emitter voltage ( $T_{pulse} = 5 \mu s, D < 0.10$ )	$V_{GE}$	$\pm 20$ $\pm 30$	V
Power Dissipation @ $T_C = 25^{\circ}C$ @ $T_C = 100^{\circ}C$	$P_D$	535 267	W
Short Circuit Withstand Time $V_{GE} = 15 V, V_{CE} = 500 V, T_J \leq 150^{\circ}C$	$T_{SC}$	10	$\mu s$
Operating junction temperature range	$T_J$	$-55$ to $+175$	$^{\circ}C$
Storage temperature range	$T_{stg}$	$-55$ to $+175$	$^{\circ}C$
Lead temperature for soldering, 1/8" from case for 5 seconds	$T_{SLD}$	260	$^{\circ}C$

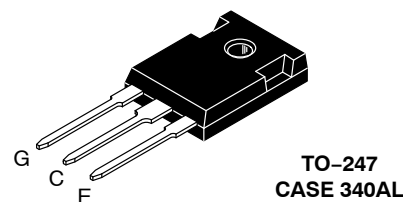
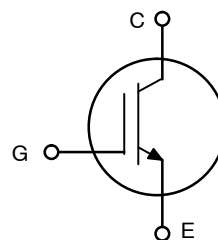
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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**40 A, 1200 V**  
 **$V_{CEsat} = 2.0 V$**   
 **$E_{off} = 1.10 mJ$**



### MARKING DIAGRAM



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

### ORDERING INFORMATION

Device	Package	Shipping
NGTG40N120FL2WG	TO-247 (Pb-Free)	30 Units / Rail

# NGTG40N120FL2WG

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.28	$^{\circ}\text{C}/\text{W}$
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	$V_{GE} = 15\text{ V}, I_C = 40\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 40\text{ A}, T_J = 175^{\circ}\text{C}$	$V_{CEsat}$	-	2.00 2.40	2.40 -	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	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$ $V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_J = 175^{\circ}\text{C}$	$I_{CES}$	-	-	0.4 2	mA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	200	nA

Input capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{ies}$	-	7385	-	pF
Output capacitance		$C_{oes}$	-	230	-	
Reverse transfer capacitance		$C_{res}$	-	140	-	
Gate charge total	$V_{CE} = 600\text{ V}, I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$	-	313	-	nC
Gate to emitter charge		$Q_{ge}$	-	61	-	
Gate to collector charge		$Q_{gc}$	-	151	-	

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-on delay time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{V}^*$	$t_{d(on)}$	-	116	-	ns	
Rise time		$t_r$	-	42	-		
Turn-off delay time		$t_{d(off)}$	-	286	-		
Fall time			$t_f$	-	121	-	mJ
Turn-on switching loss		$E_{on}$	-	3.4	-		
Turn-off switching loss		$E_{off}$	-	1.1	-		
Total switching loss		$E_{ts}$	-	4.5	-		
Turn-on delay time	$T_J = 175^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 40\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{V}^*$	$t_{d(on)}$	-	111	-	ns	
Rise time		$t_r$	-	43	-		
Turn-off delay time		$t_{d(off)}$	-	304	-		
Fall time			$t_f$	-	260	-	mJ
Turn-on switching loss		$E_{on}$	-	4.4	-		
Turn-off switching loss		$E_{off}$	-	2.5	-		
Total switching loss		$E_{ts}$	-	6.9	-		

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.

\*Includes diode reverse recovery loss using NGTB40N120FL2WG.

# NGTG40N120FL2WG

## TYPICAL CHARACTERISTICS

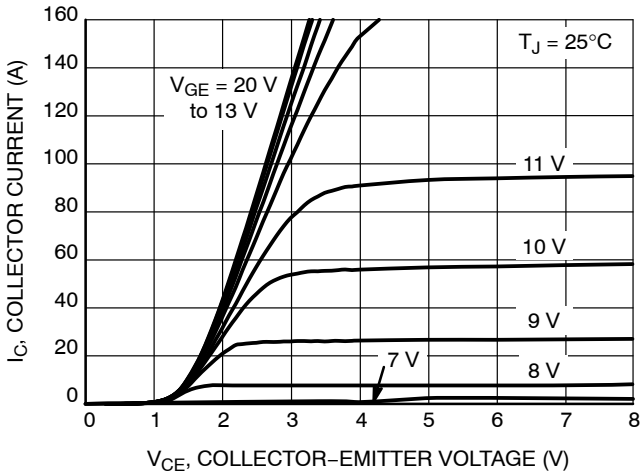


Figure 1. Output Characteristics

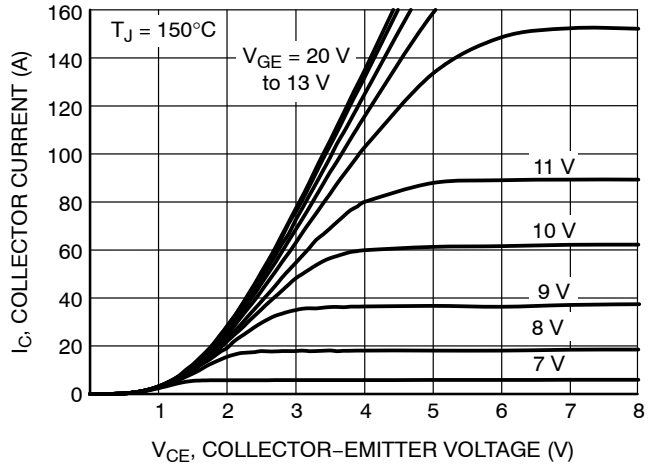


Figure 2. Output Characteristics

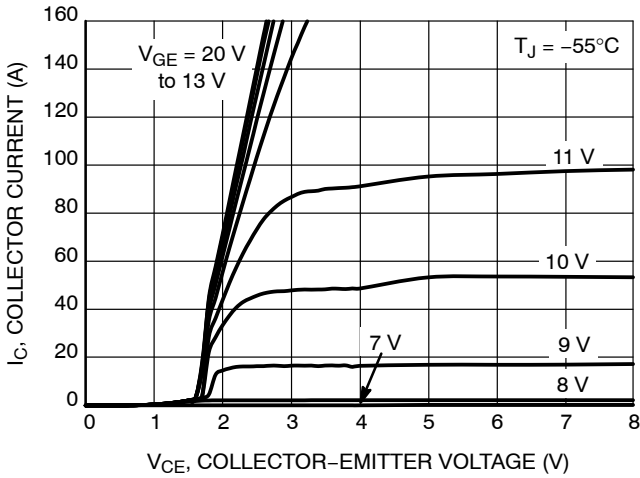


Figure 3. Output Characteristics

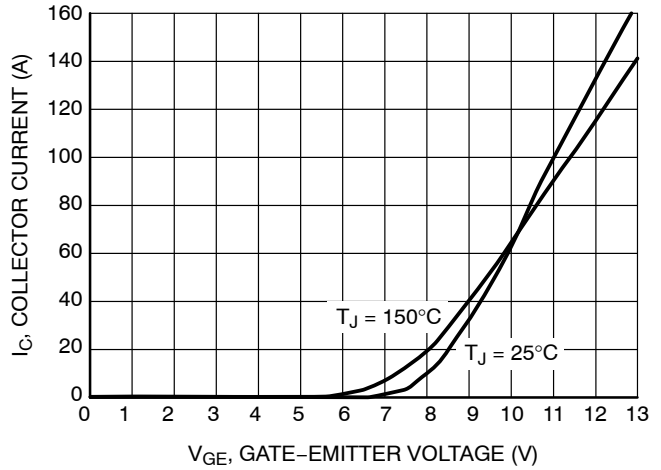


Figure 4. Typical Transfer Characteristics

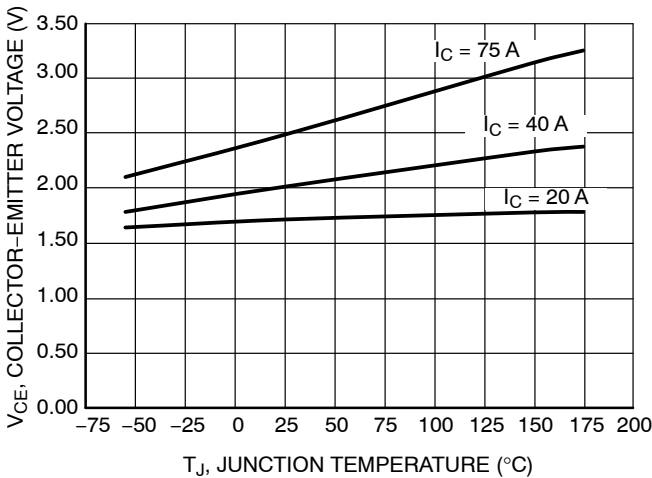


Figure 5.  $V_{CE(sat)}$  vs  $T_J$

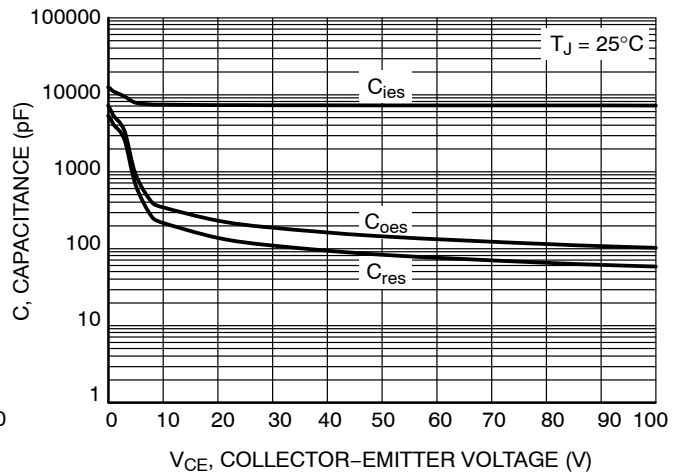


Figure 6. Typical Capacitance

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## TYPICAL CHARACTERISTICS

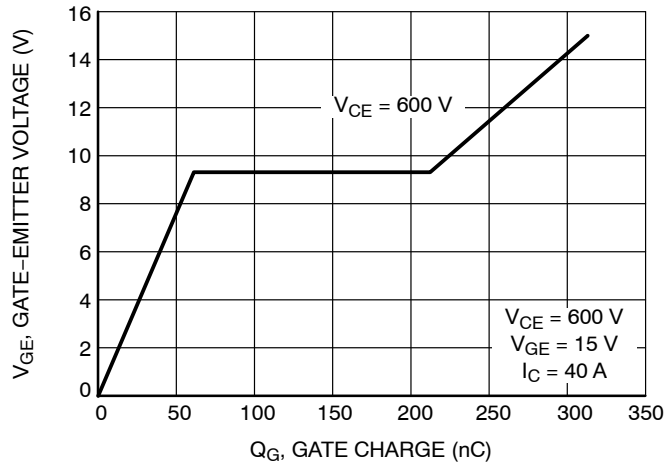


Figure 7. Typical Gate Charge

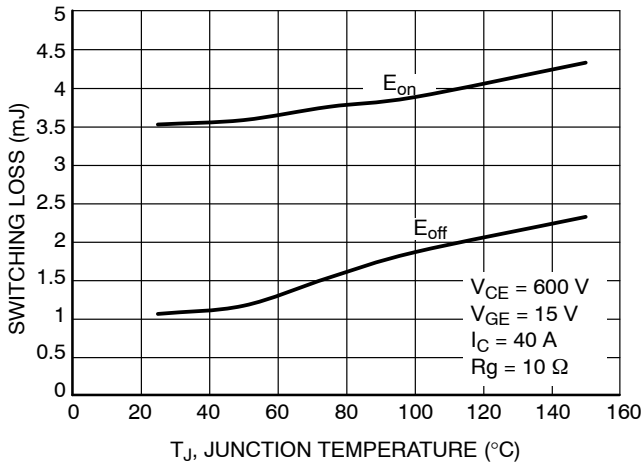


Figure 8. Switching Loss vs. Temperature

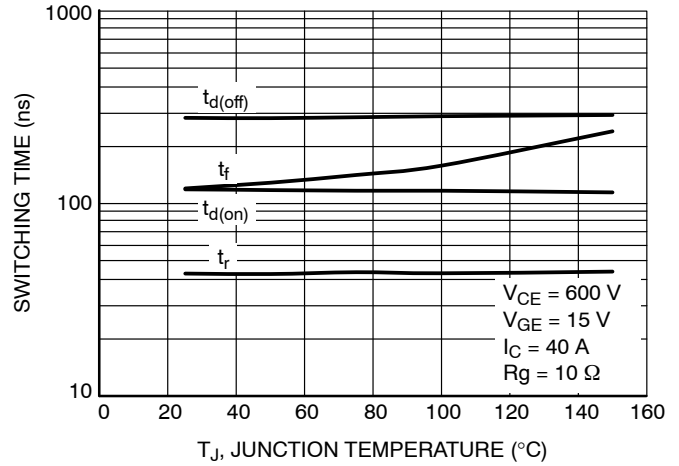


Figure 9. Switching Time vs. Temperature

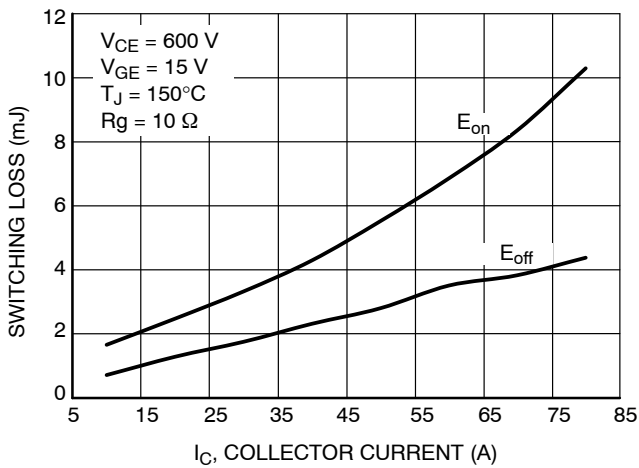


Figure 10. Switching Loss vs.  $I_C$

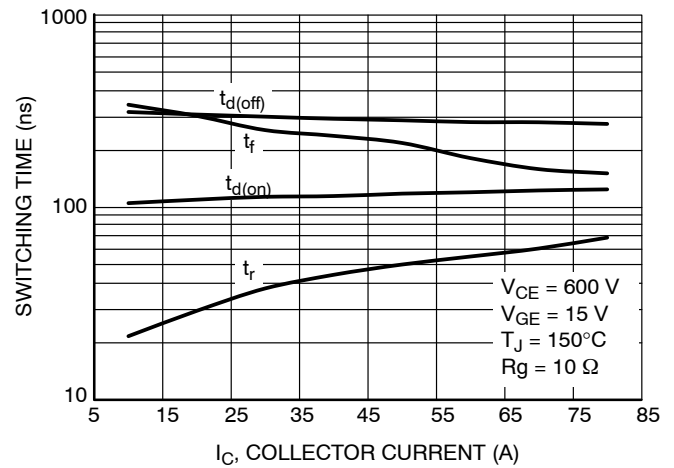


Figure 11. Switching Time vs.  $I_C$

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## TYPICAL CHARACTERISTICS

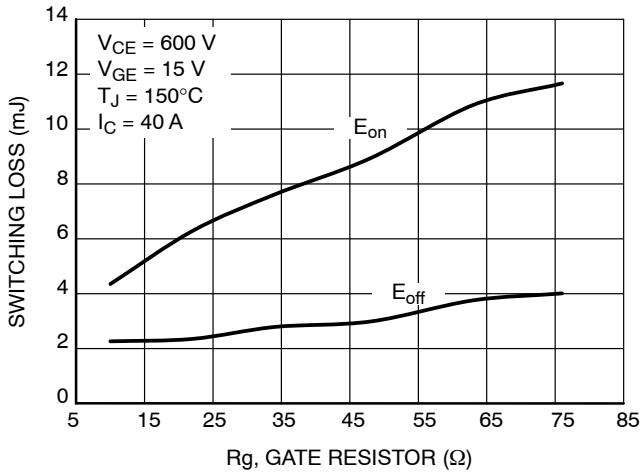


Figure 12. Switching Loss vs. R<sub>g</sub>

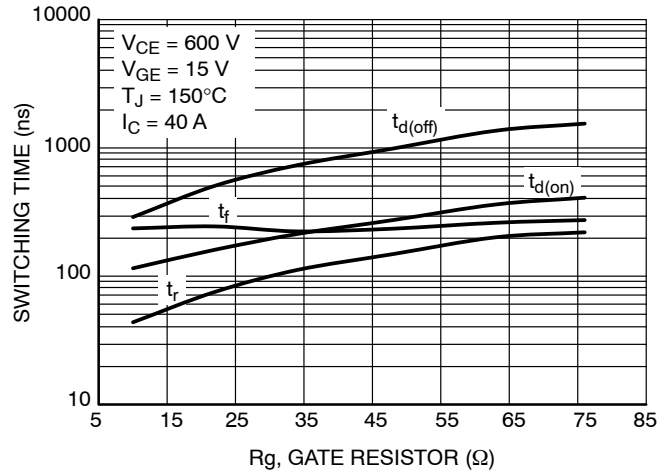


Figure 13. Switching Time vs. R<sub>g</sub>

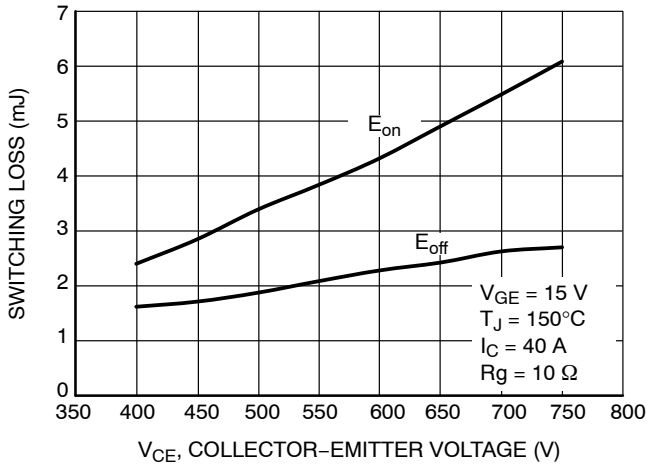


Figure 14. Switching Loss vs. V<sub>CE</sub>

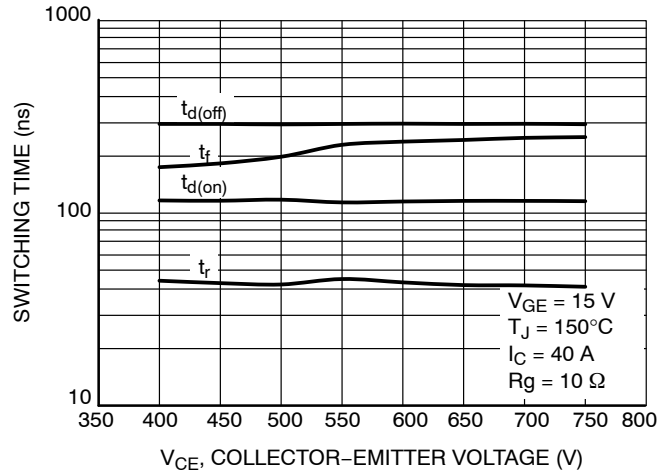


Figure 15. Switching Time vs. V<sub>CE</sub>

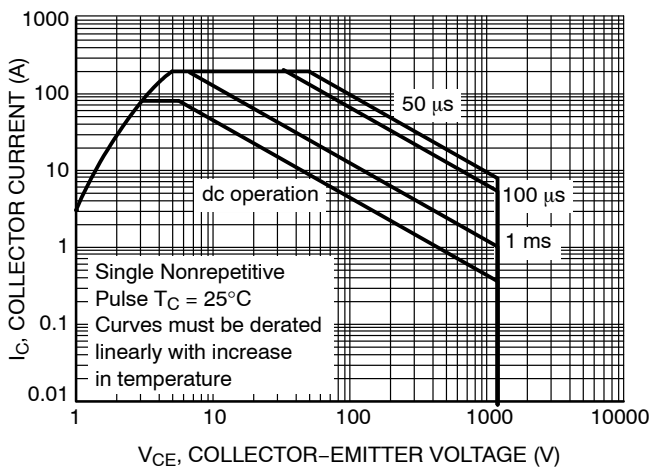


Figure 16. Safe Operating Area

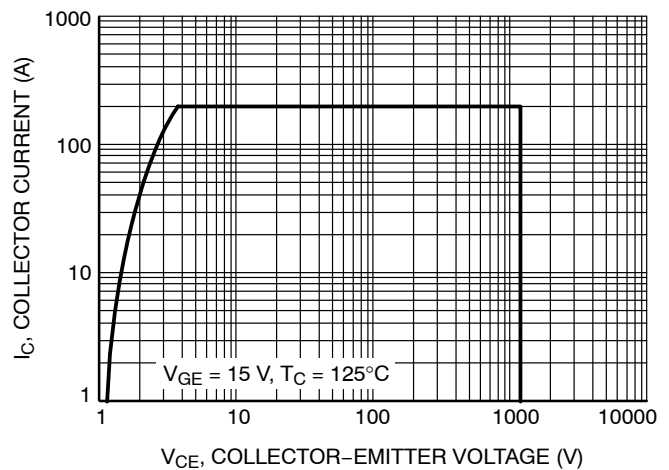


Figure 17. Reverse Bias Safe Operating Area

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## TYPICAL CHARACTERISTICS

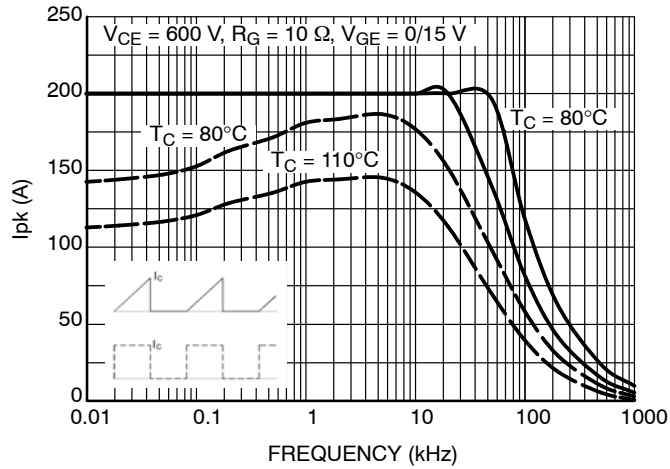


Figure 18. Collector Current vs. Switching Frequency

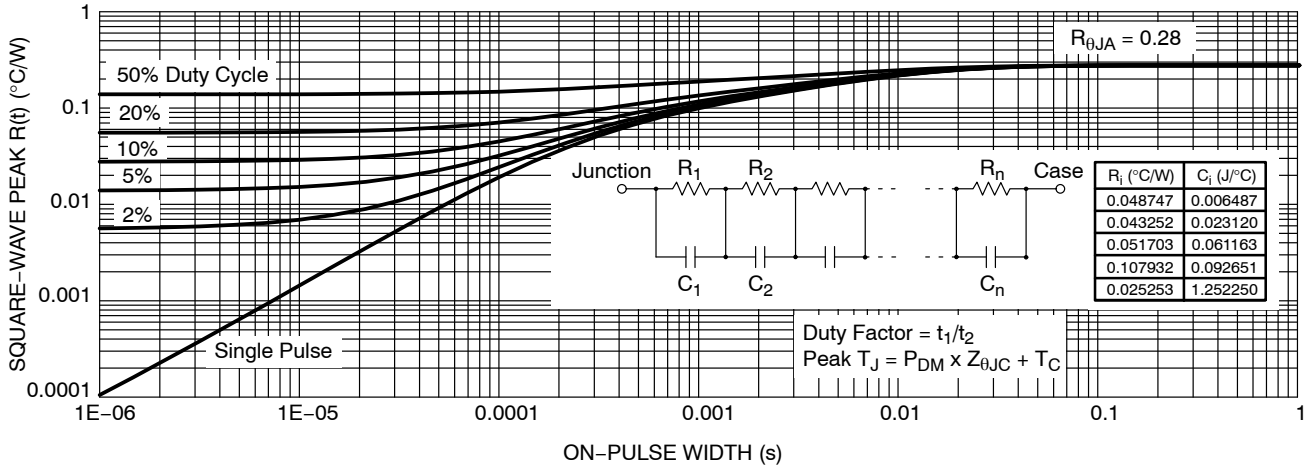


Figure 19. IGBT Transient Thermal Impedance

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Figure 20. Test Circuit for Switching Characteristics

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Figure 21. Definition of Turn On Waveform



NGTG40N120FL2WG

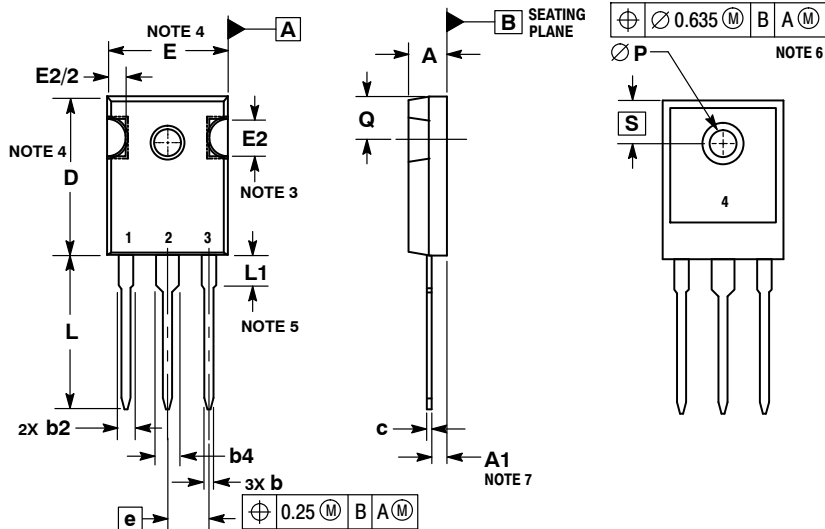


Figure 22. Definition of Turn Off Waveform

# NGTG40N120FL2WG

## PACKAGE DIMENSIONS

TO-247  
CASE 340AL  
ISSUE A



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. ØP 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.

DIM	MILLIMETERS	
	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	20.30	21.40
E	15.50	16.25
E2	4.32	5.49
e	5.45 BSC	
L	19.80	20.80
L1	3.50	4.50
P	3.55	3.65
Q	5.40	6.20
S	6.15 BSC	

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