

# NGTB25N120FLWG

## IGBT

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective 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. Incorporated into the device is a soft and fast 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
- 10  $\mu$ s Short Circuit Capability
- Low Gate Charge
- Soft, Fast Free Wheeling Diode
- These are Pb-Free Devices

### Typical Applications

- Solar Inverter
- UPS Inverter

### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	$V_{CES}$	1200	V
Collector current @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$I_C$	50 25	A
Pulsed collector current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{CM}$	200	A
Diode forward current @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$I_F$	50 25	A
Diode pulsed current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{FM}$	200	A
Gate-emitter voltage	$V_{GE}$	$\pm 20$	V
Power Dissipation @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	$P_D$	192 77	W
Short Circuit Withstand Time $V_{GE} = 15\text{ V}$ , $V_{CE} = 500\text{ V}$ , $T_J \leq 150^\circ\text{C}$	$T_{SC}$	10	$\mu\text{s}$
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(note 3)	$T_{SLD}$	260	$^\circ\text{C}$

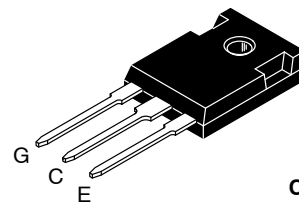
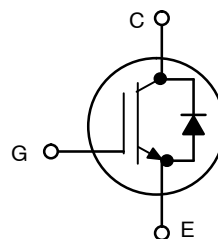
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



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**25 A, 1200 V**  
 **$V_{CEsat} = 2.0\text{ V}$**   
 **$E_{off} = 0.95\text{ mJ}$**



**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
NGTB25N120FLWG	TO-247 (Pb-Free)	30 Units / Rail

# NGTB25N120FLWG

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.65	$^{\circ}\text{C/W}$
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	1.5	$^{\circ}\text{C/W}$
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^{\circ}\text{C/W}$

## 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	$V_{GE} = 15\text{ V}, I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 25\text{ A}, T_J = 150^{\circ}\text{C}$	$V_{CEsat}$	1.55 -	2.0 2.2	2.2 -	V
Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 250\ \mu\text{A}$	$V_{GE(th)}$	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	mA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	$I_{GES}$	-	-	100	nA

### DYNAMIC CHARACTERISTIC

Input capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{ies}$	-	5200	-	pF
Output capacitance		$C_{oes}$	-	144	-	
Reverse transfer capacitance		$C_{res}$	-	94	-	
Gate charge total	$V_{CE} = 600\text{ V}, I_C = 25\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$		220		nC
Gate to emitter charge		$Q_{ge}$		40		
Gate to collector charge		$Q_{gc}$		98		

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-on delay time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 25\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$		91		ns	
Rise time		$t_r$		26			
Turn-off delay time		$t_{d(off)}$		228			
Fall time			$t_f$		160		mJ
Turn-on switching loss		$E_{on}$		1.50			
Turn-off switching loss		$E_{off}$		0.95			
Total switching loss			$E_{ts}$		2.45		
Turn-on delay time	$T_J = 125^{\circ}\text{C}$ $V_{CC} = 600\text{ V}, I_C = 25\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$		88		ns	
Rise time		$t_r$		28			
Turn-off delay time		$t_{d(off)}$		240			
Fall time			$t_f$		270		mJ
Turn-on switching loss		$E_{on}$		1.8			
Turn-off switching loss		$E_{off}$		1.6			
Total switching loss			$E_{ts}$		3.4		

# NGTB25N120FLWG

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
<b>DIODE CHARACTERISTIC</b>						
Forward voltage	$V_{GE} = 0\text{ V}, I_F = 25\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 25\text{ A}, T_J = 150^\circ\text{C}$	$V_F$		2.2 2.5	2.8	V
Reverse recovery time	$T_J = 25^\circ\text{C}$ $I_F = 25\text{ A}, V_R = 400\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$	$t_{rr}$		240		ns
Reverse recovery charge		$Q_{rr}$		1.5		$\mu\text{C}$
Reverse recovery current		$I_{rrm}$		15		A
Reverse recovery time	$T_J = 125^\circ\text{C}$ $I_F = 25\text{ A}, V_R = 400\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$	$t_{rr}$		260		ns
Reverse recovery charge		$Q_{rr}$		2.0		$\mu\text{C}$
Reverse recovery current		$I_{rrm}$		19		A

# NGTB25N120FLWG

## TYPICAL CHARACTERISTICS

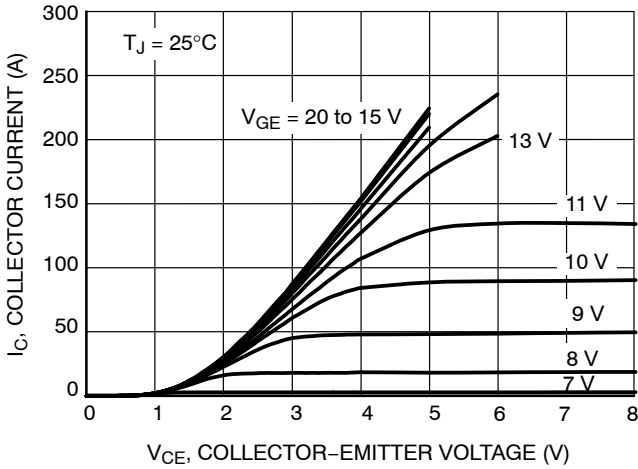


Figure 1. Output Characteristics

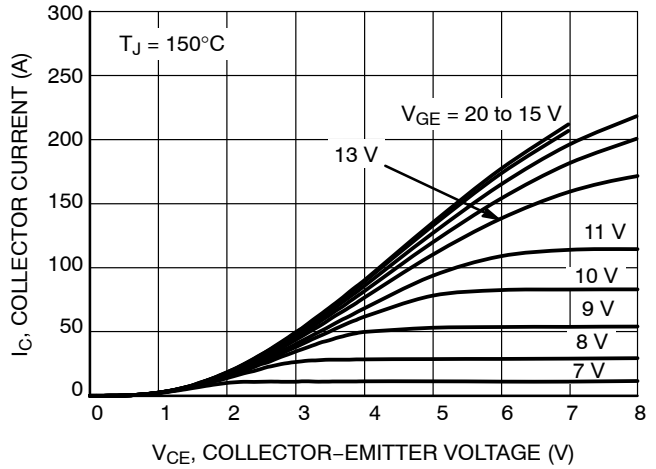


Figure 2. Output Characteristics

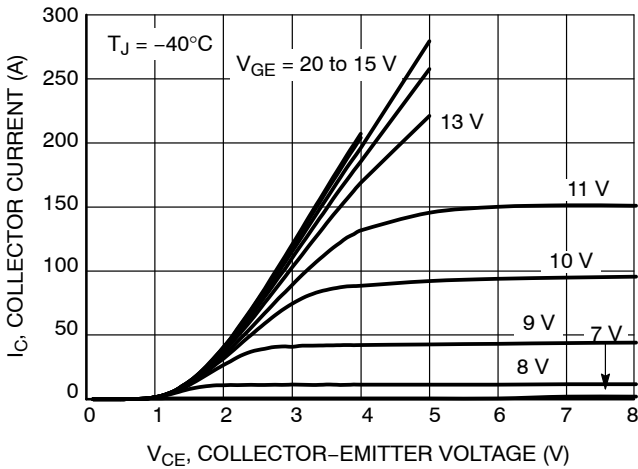


Figure 3. Output Characteristics

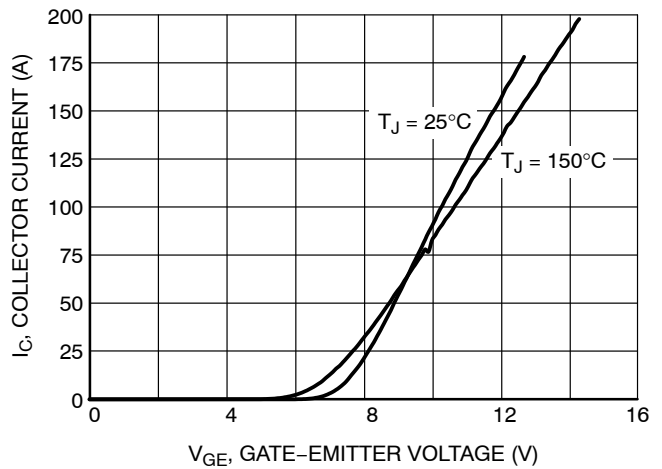


Figure 4. Typical Transfer Characteristics

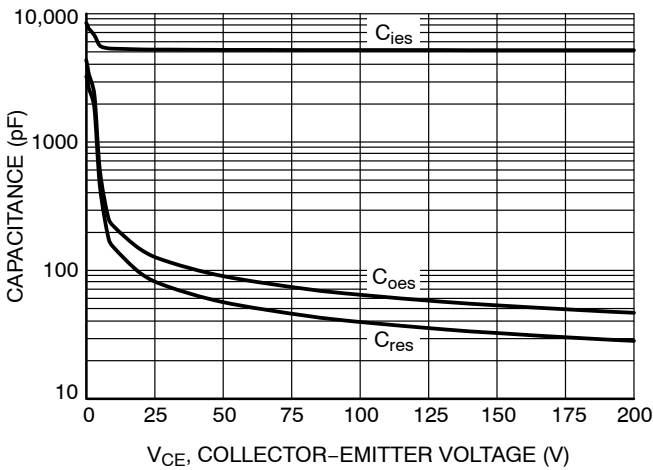


Figure 5. Typical Capacitance

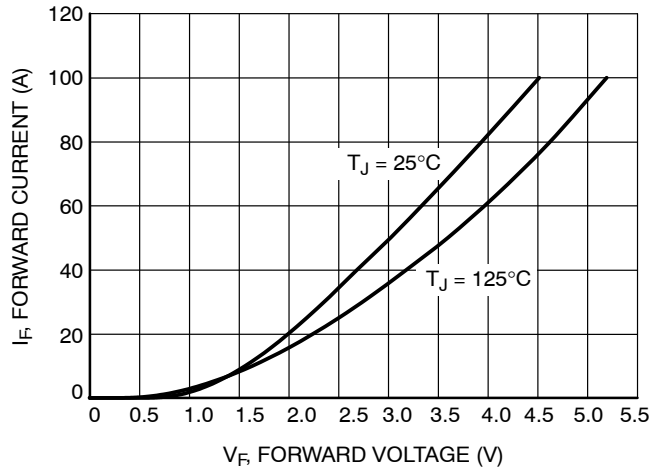


Figure 6. Diode Forward Characteristics

# NGTB25N120FLWG

## TYPICAL CHARACTERISTICS

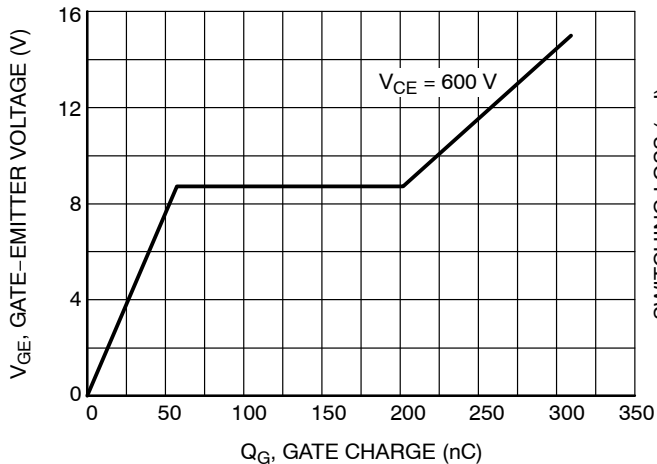


Figure 7. Typical Gate Charge

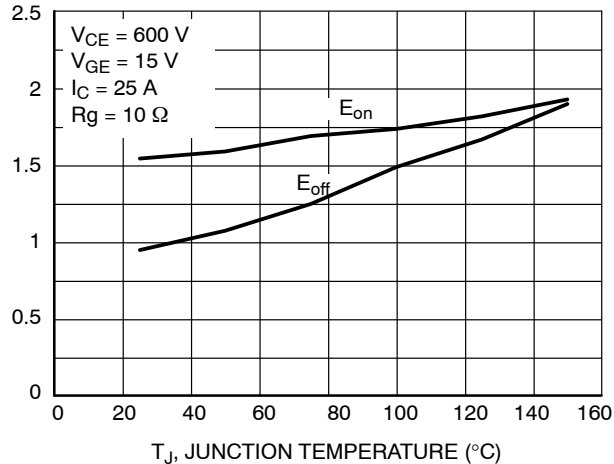


Figure 8. Energy Loss vs. Temperature

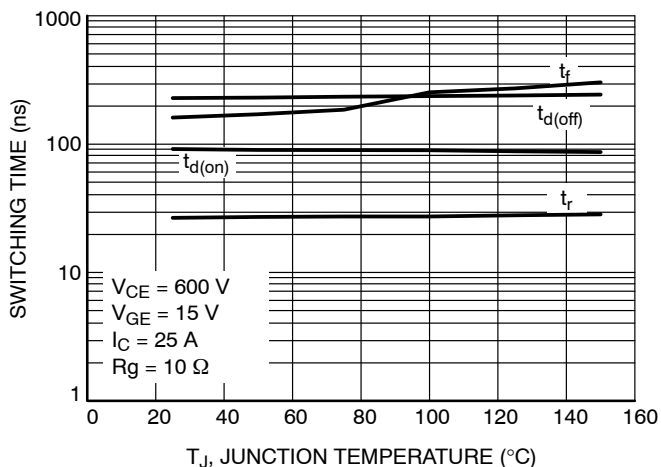


Figure 9. Switching Time vs. Temperature

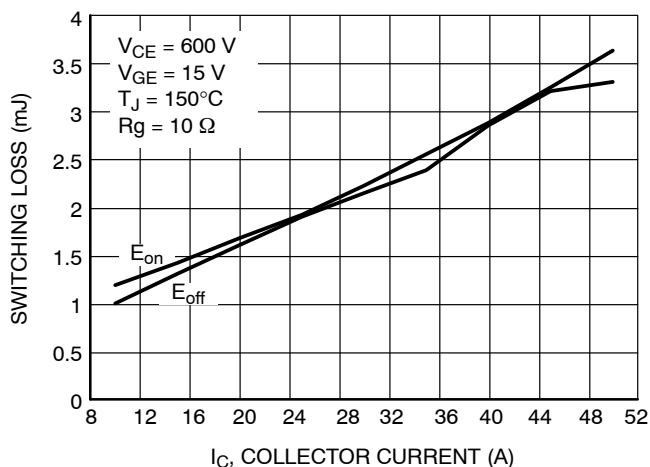


Figure 10. Energy Loss vs.  $I_C$

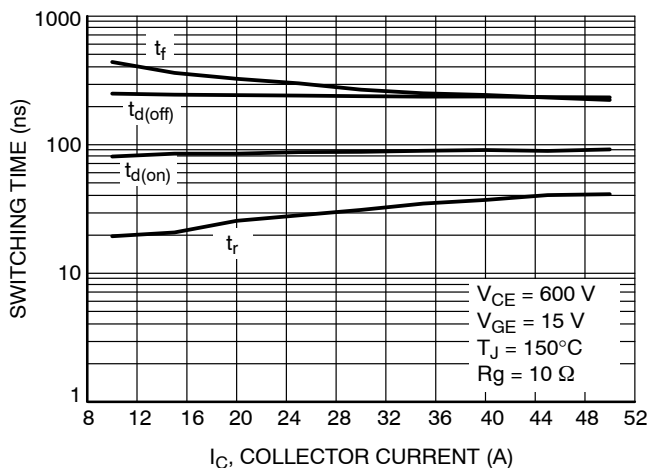


Figure 11. Switching Time vs.  $I_C$

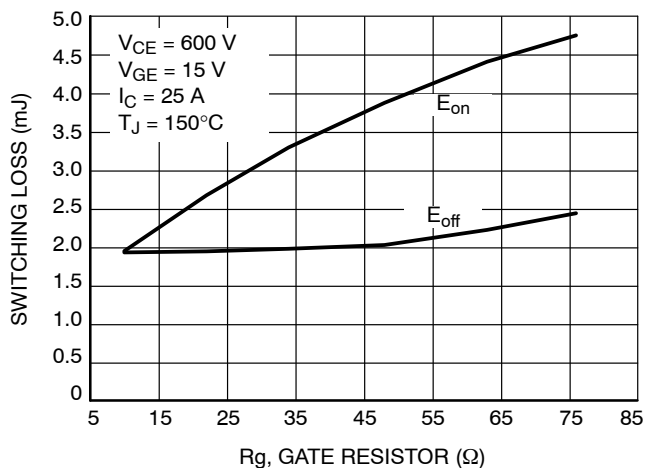


Figure 12. Energy Loss vs.  $R_g$

# NGTB25N120FLWG

## TYPICAL CHARACTERISTICS

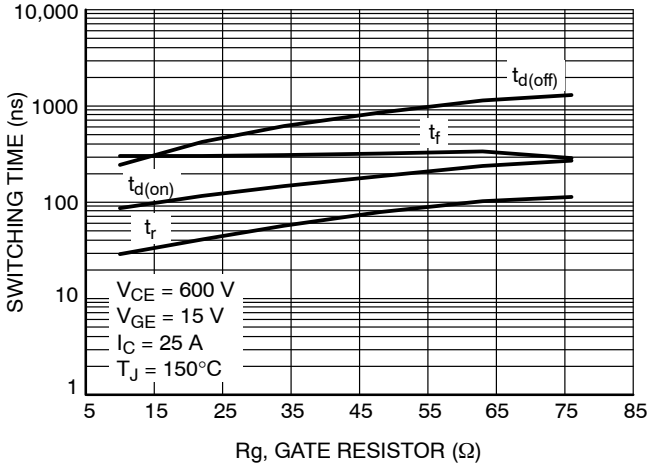


Figure 13. Switching Time vs.  $R_g$

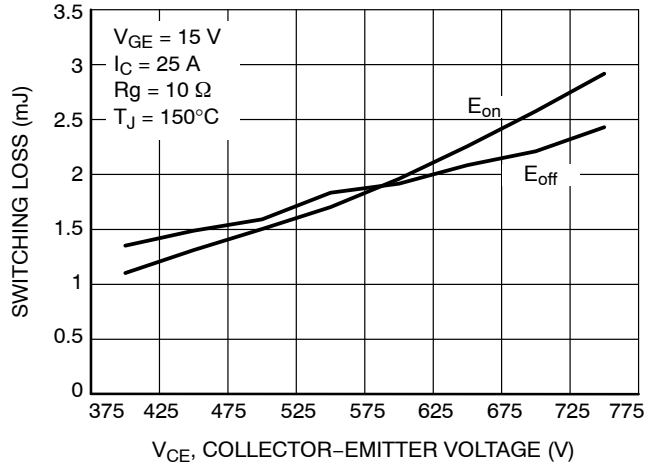


Figure 14. Energy Loss vs.  $V_{CE}$

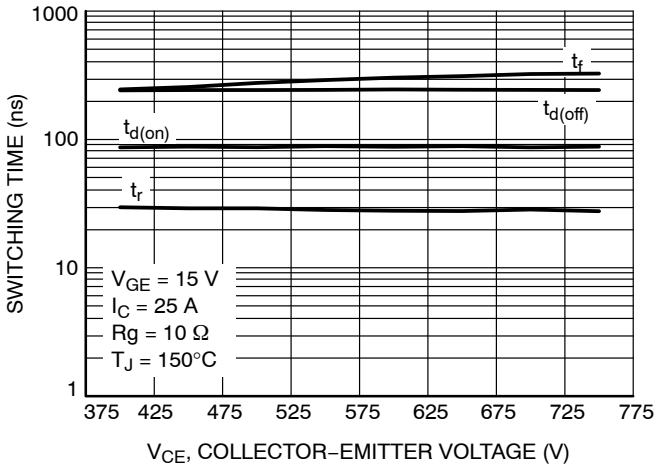


Figure 15. Switching Time vs.  $V_{CE}$

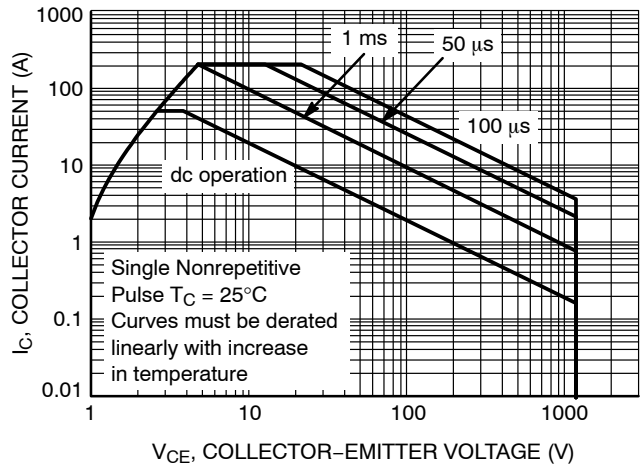


Figure 16. Safe Operating Area

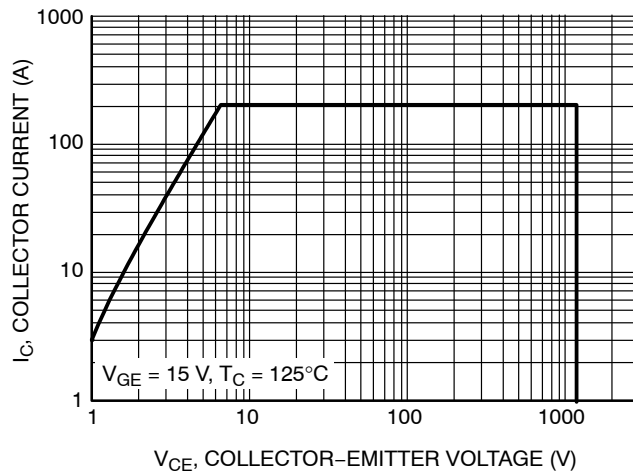


Figure 17. Reverse Bias Safe Operating Area

# NGTB25N120FLWG

## TYPICAL CHARACTERISTICS

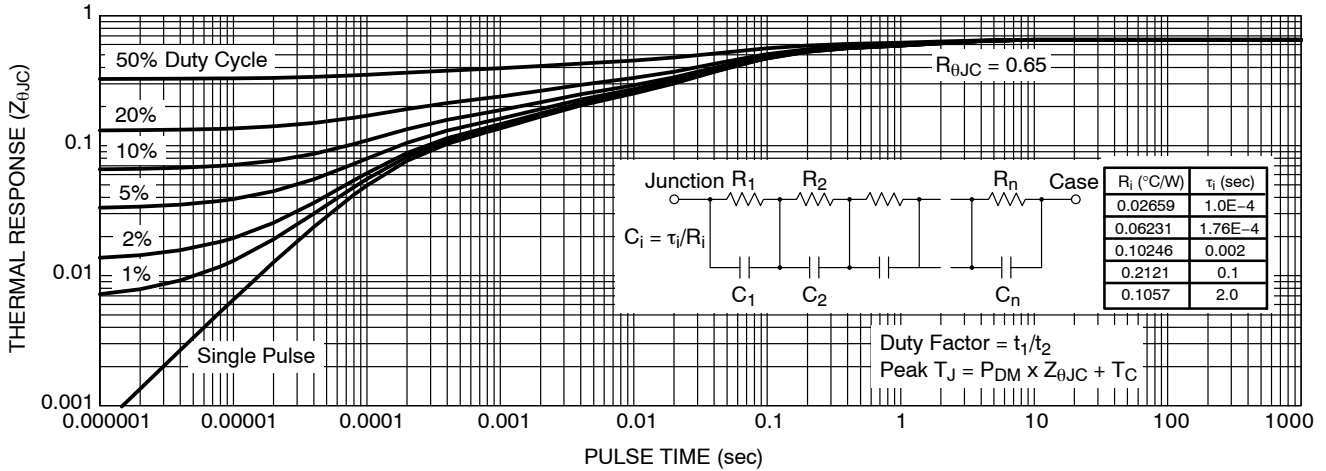


Figure 18. IGBT Transient Thermal Impedance

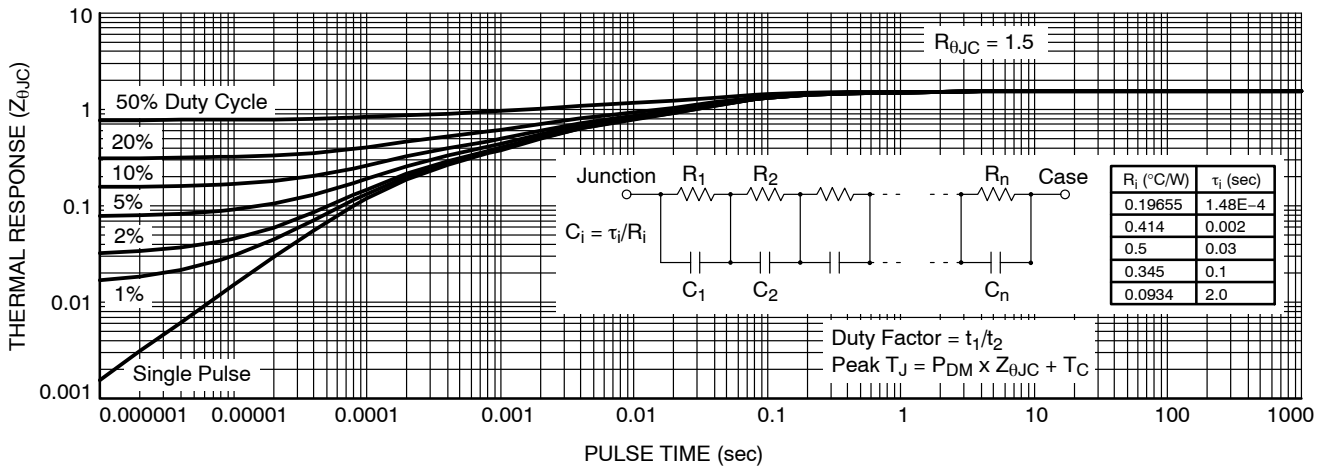


Figure 19. Diode Transient Thermal Impedance

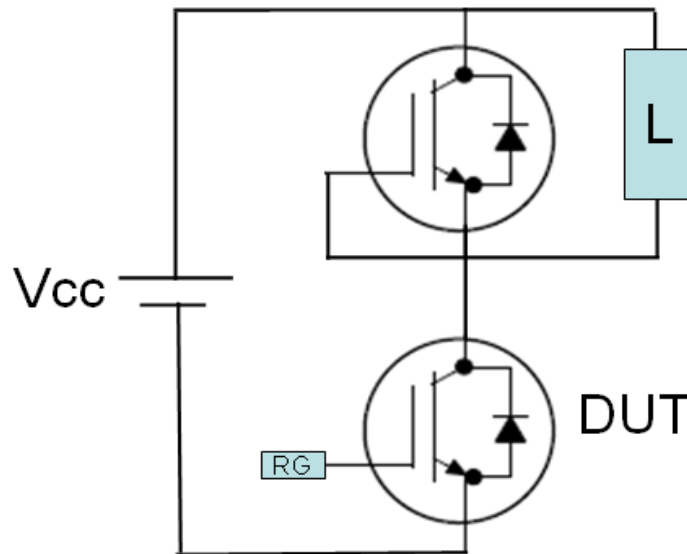


Figure 20. Test Circuit for Switching Characteristics

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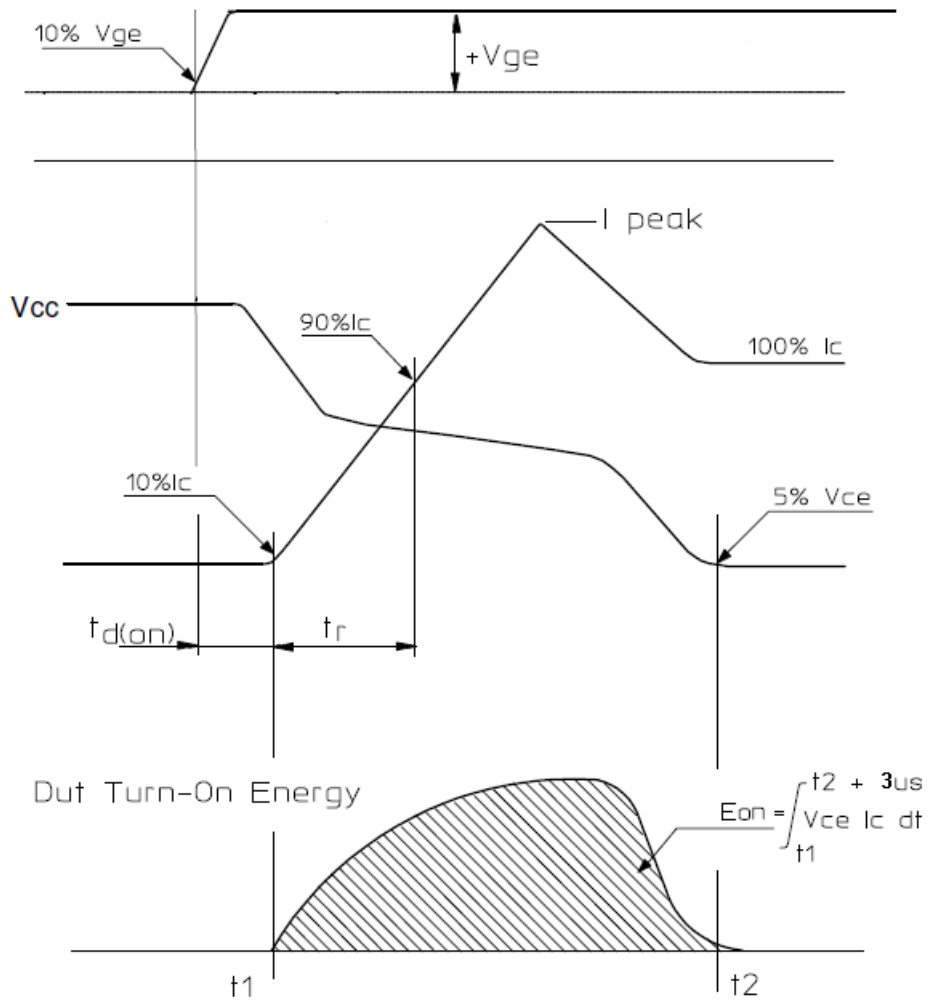


Figure 21. Definition of Turn On Waveform



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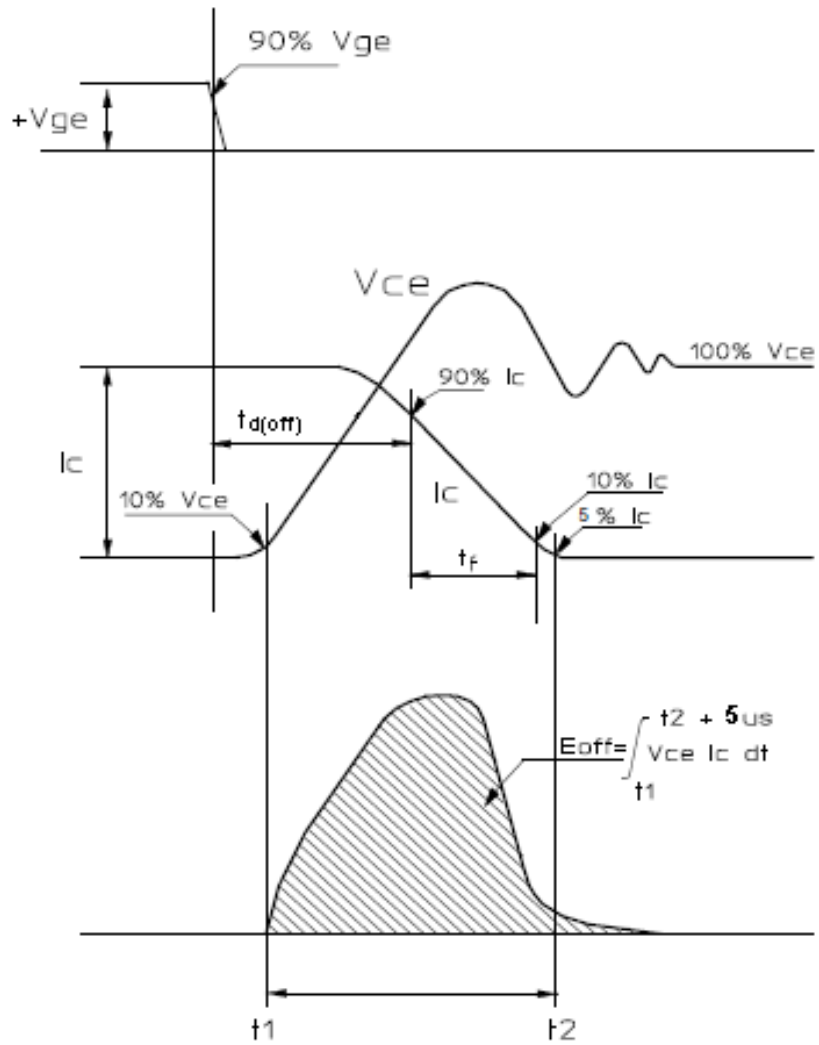
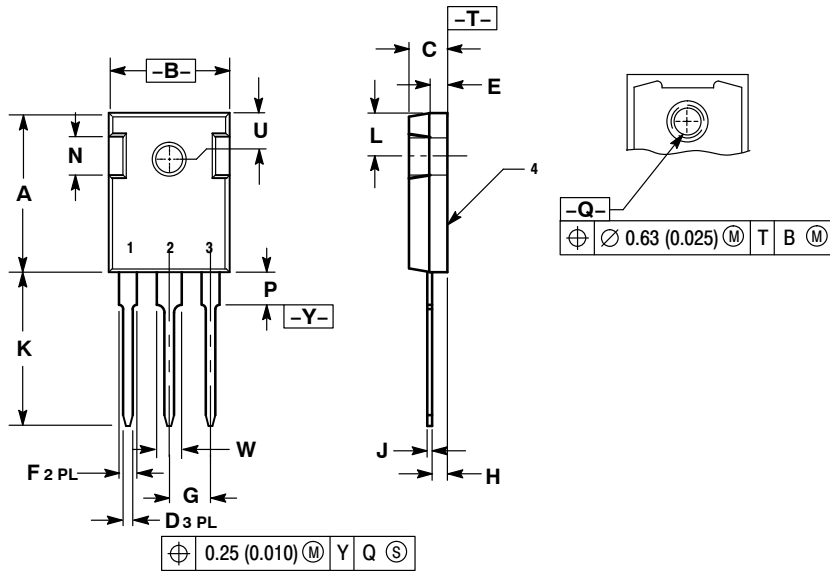


Figure 22. Definition of Turn Off Waveform

# NGTB25N120FLWG

## PACKAGE DIMENSIONS

TO-247  
CASE 340L-02  
ISSUE F



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. 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

- STYLE 4:  
PIN 1. GATE  
2. COLLECTOR  
3. EMITTER  
4. COLLECTOR

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