

# NGTB20N135IHRWG

## Product Preview

### IGBT with Monolithic Free Wheeling Diode

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.

#### Features

- Extremely Efficient Trench with Fieldstop Technology
- 1350 V Breakdown Voltage
- Optimized for Low Case Temperature in IH Cooker Application
- Reliable and Cost Effective Single Die Solution
- These are Pb-Free Devices

#### Typical Applications

- Inductive Heating
- Consumer Appliances
- Soft Switching

#### ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	$V_{CES}$	1350	V
Collector current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	$I_C$	40 20	A
Pulsed collector current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{CM}$	80	A
Diode forward current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	$I_F$	40 20	A
Diode pulsed current, $T_{pulse}$ limited by $T_{Jmax}$	$I_{FM}$	80	A
Gate-emitter voltage Transient Gate-emitter Voltage ( $T_{pulse} = 5 \mu\text{s}$ , $D < 0.10$ )	$V_{GE}$	$\pm 20$ $\pm 25$	V
Power Dissipation @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	$P_D$	350 140	W
Operating junction temperature range	$T_J$	-40 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.

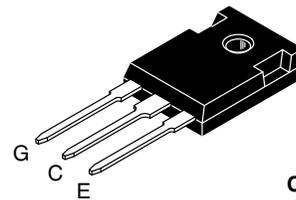
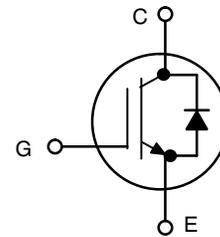
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20 A, 1350 V  
 $V_{CESat} = 2.20 \text{ V}$   
 $E_{off} = 0.60 \text{ mJ}$



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
NGTB20N135IHRWG	TO-247 (Pb-Free)	30 Units / Rail

# NGTB20N135IHRWG

## THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.357	°C/W
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	0.357	°C/W
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	°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	$V_{GE} = 0\text{ V}, I_C = 500\ \mu\text{A}$	$V_{(BR)CES}$	1350	-	-	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 175^\circ\text{C}$	$V_{CEsat}$	-	2.20 2.40	2.65 -	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 2.0	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	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	$C_{ies}$	-	5290	-	pF
Output capacitance		$C_{oes}$	-	124	-	
Reverse transfer capacitance		$C_{res}$	-	100	-	
Gate charge total	$V_{CE} = 600\text{ V}, I_C = 20\text{ A}, V_{GE} = 15\text{ V}$	$Q_g$		234		nC
Gate to emitter charge		$Q_{ge}$		39		
Gate to collector charge		$Q_{gc}$		105		

### SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-off delay time	$T_J = 25^\circ\text{C}$ $V_{CC} = 600\text{ V}, I_C = 20\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(off)}$		245		ns
Fall time		$t_f$		175		
Turn-off switching loss		$E_{off}$		0.60		
Turn-off delay time	$T_J = 150^\circ\text{C}$ $V_{CC} = 600\text{ V}, I_C = 20\text{ A}$ $R_g = 10\ \Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(off)}$		270		ns
Fall time		$t_f$		290		
Turn-off switching loss		$E_{off}$		1.40		

### DIODE CHARACTERISTIC

Forward voltage	$V_{GE} = 0\text{ V}, I_F = 20\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 20\text{ A}, T_J = 175^\circ\text{C}$	$V_F$		1.80 2.70	2.10	V
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NGTB20N135IHRWG

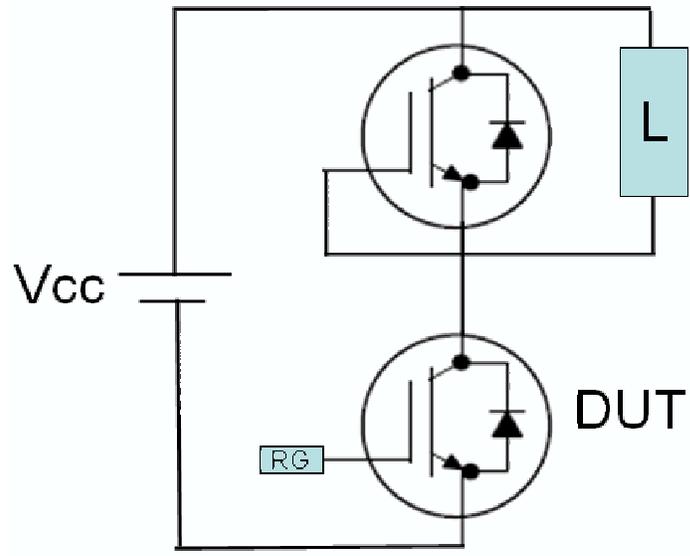


Figure 1. Test Circuit for Switching Characteristics

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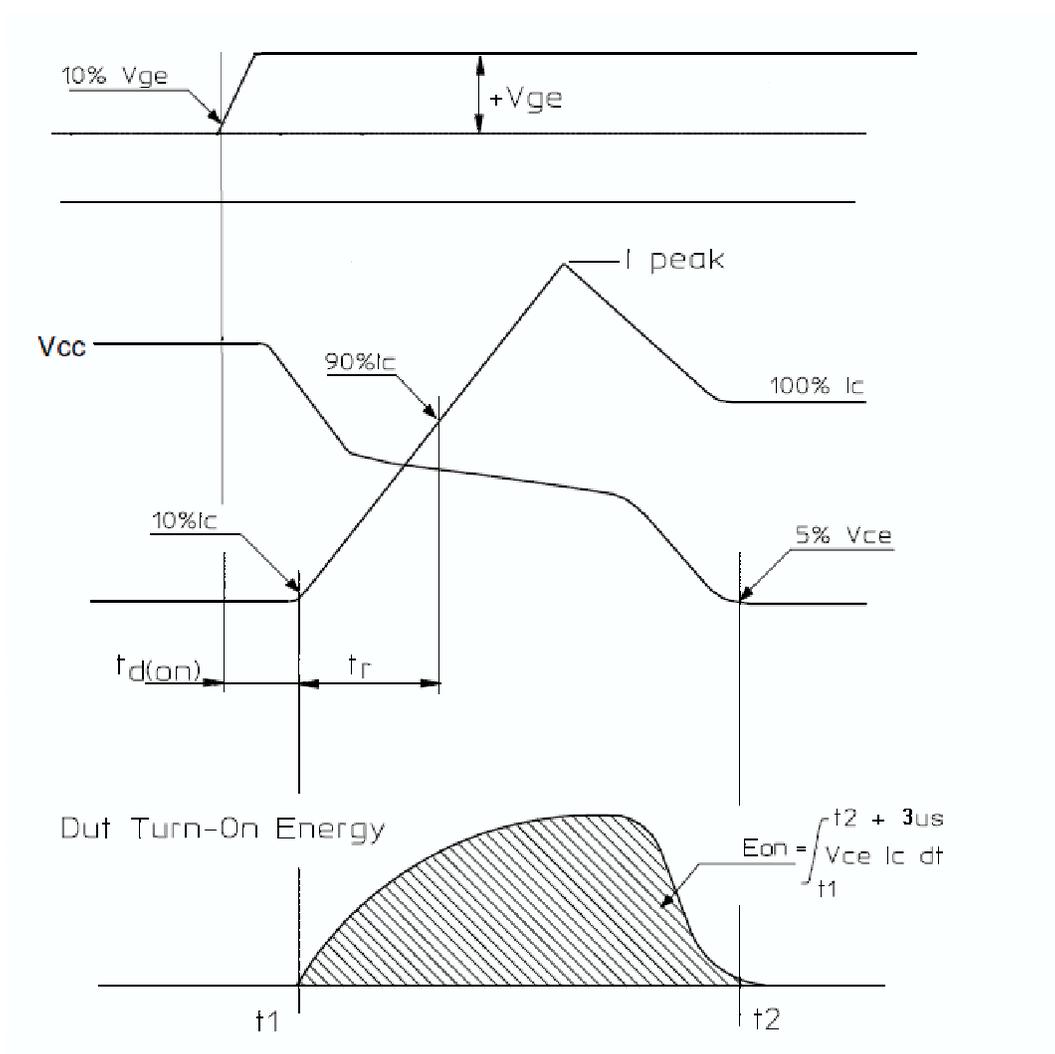


Figure 2. Definition of Turn On Waveform

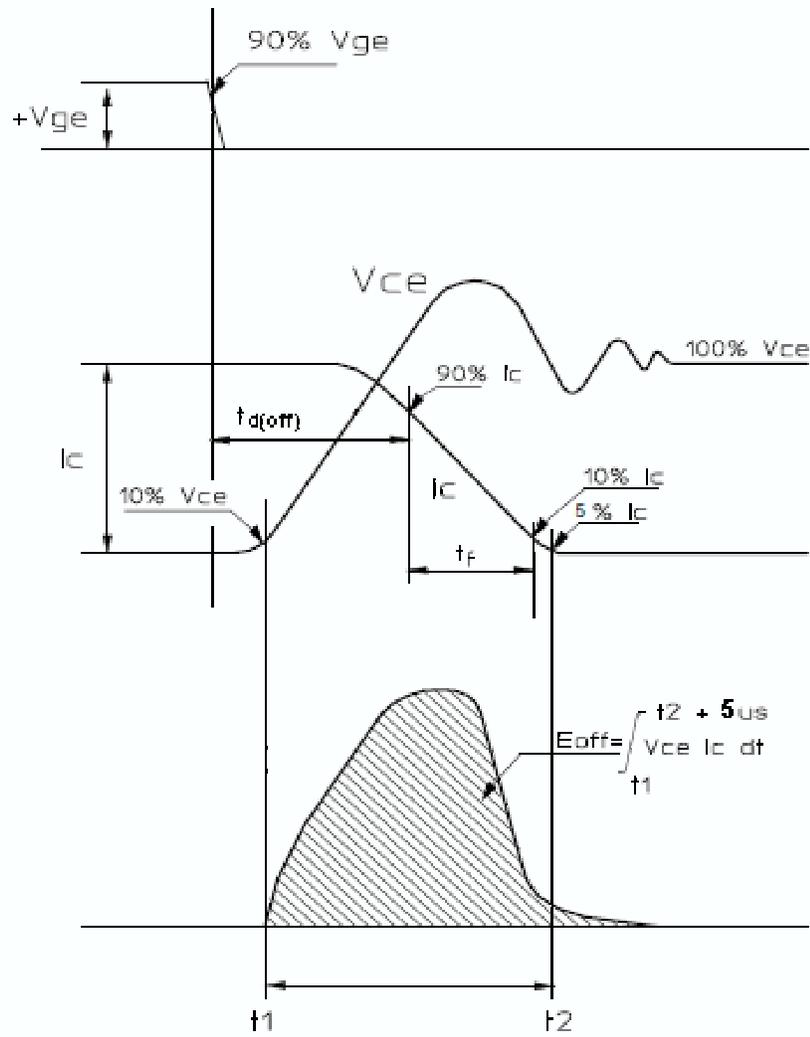
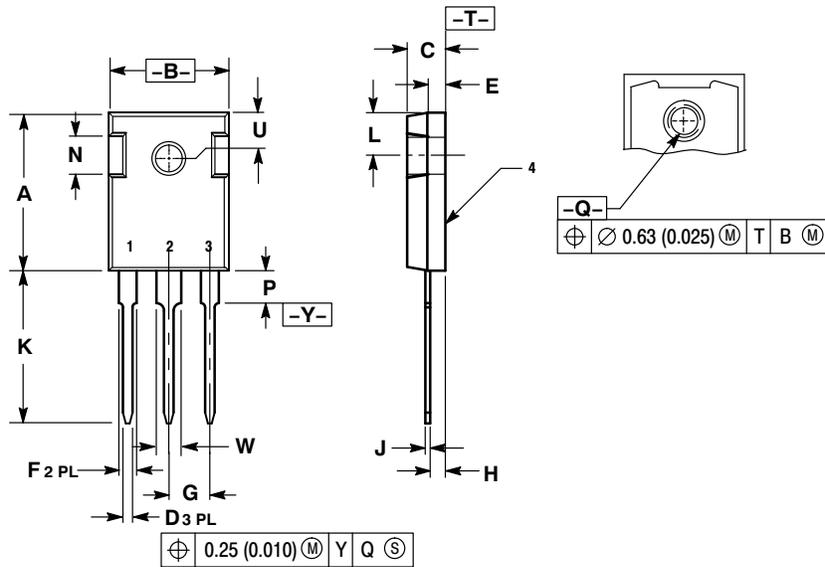


Figure 3. Definition of Turn Off Waveform

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## 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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