NGTB20N120IHRWG

IGBT with Monolithic Free Wheeling Diode

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop (FS) Trench construction, provides and superior performance in demanding switching applications, and offers low on−state voltage with minimal switching loss. The IGBT is well suited for resonant or soft switching applications.

Features

- Extremely Efficient Trench with Fieldstop Technology
- Low Switching Loss Reduces System Power Dissipation
- Optimized for Low Losses 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 @ T_J = 25°C	V_{CES}	1200	V
Collector current @ T_C = 25°C @ T_C = 100°C	I_C	 40 20	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}, 10 μs Pulse, V_{GE} = 15 V	I_{CM}	120	A
Diode forward current @ T_C = 25°C @ T_C = 100°C	I_F	 40 20	A
Diode pulsed current, T_{pulse} limited by T_{Jmax}, 10 μs Pulse, V_{GE} = 0 V	I_{FM}	120	A
Gate−emitter voltage Transient Gate−emitter voltage (T_{pulse} = 5 μs, D < 0.10)	V_{GE}	±20 ±25	V
Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 384 192	W
Operating junction temperature range	T_J	−40 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 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, 1200 V
V_{CEsat} = 2.10 V
E_{off} = 0.45 mJ

TO−247
CASE 340AL

MARKING DIAGRAM

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

ORDERING INFORMATION

Device	Package	Shipping
NGTB20N120IHRWG	TO−247 (Pb−Free)	30 Units / Rail

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case	$R_{\theta JC}$	0.39	°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 = 5 mA	$V_{(BR)CES}$	1200	–	–	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A V_{GE} = 15 V, I_C = 20 A, T_J = 175°C	V_{CEsat}	– –	2.10 2.30	2.45 –	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 250 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}	– –	– –	0.2 2.8	mA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	100	nA
DYNAMIC CHARACTERISTIC						
Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	5320	–	pF
Output capacitance		C_{oes}	–	124	–	
Reverse transfer capacitance		C_{res}	–	100	–	
Gate charge total	V_{CE} = 600 V, I_C = 20 A, V_{GE} = 15 V	Q_g	–	225	–	nC
Gate to emitter charge		Q_{ge}	–	36	–	
Gate to collector charge		Q_{gc}	–	98	–	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−off delay time	T_J = 25°C V_{CC} = 600 V, I_C = 20 A R_g = 10 Ω V_{GE} = 0 V/ 15V	$t_{d(off)}$	–	235	–	ns
Fall time		t_f	–	155	–	
Turn−off switching loss		E_{off}	–	0.45	–	mJ
Turn−off delay time	T_J = 150°C V_{CC} = 600 V, I_C = 20 A R_g = 10 Ω V_{GE} = 0 V/ 15V	$t_{d(off)}$	–	255	–	ns
Fall time		t_f	–	250	–	
Turn−off switching loss		E_{off}	–	1.10	–	mJ
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 20 A V_{GE} = 0 V, I_F = 20 A, T_J = 175°C	V_F	– –	1.75 2.50	2.10	V

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

TYPICAL CHARACTERISTICS

Figure 7. Diode Forward Characteristics

Figure 8. Typical Gate Charge

Figure 9. Switching Loss vs. Temperature

Figure 10. Switching Time vs. Temperature

Figure 11. Switching Loss vs. I_C

Figure 12. Switching Time vs. I_C

TYPICAL CHARACTERISTICS

Figure 13. Switching Loss vs. R_g

Figure 14. Switching Time vs. R_g

Figure 15. Switching Loss vs. V_{CE}

Figure 16. Switching Time vs. V_{CE}

Figure 17. Safe Operating Area

Figure 18. Reverse Bias Safe Operating Area

TYPICAL CHARACTERISTICS

Figure 19. Collector Current vs. Switching Frequency

Figure 20. Typical $V_{(BR)CES}$ vs. Temperature

R_i (°C/W)	τ_i (sec)
0.04597	0.000218
0.000101	0.031311
0.009460	0.001057
0.004201	0.007527
0.020965	0.004770
0.040205	0.007965
0.003094	0.323174
0.037895	0.083449
0.016194	0.617513
0.000100	316.228
0.246889	0.405040

Figure 21. IGBT Transient Thermal Impedance

Figure 22. Test Circuit for Switching Characteristics

Figure 23. Definition of Turn On Waveform

Figure 24. Definition of Turn Off Waveform

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. ∅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	20.30	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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