NGTB20N120IHSWG

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

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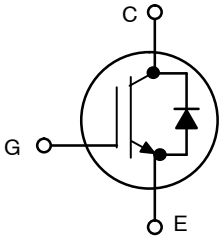
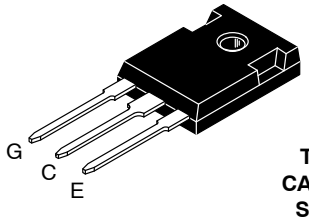
20 A, 1200 V
V_{CEsat} = 2.10 V
E_{off} = 0.65 mJ





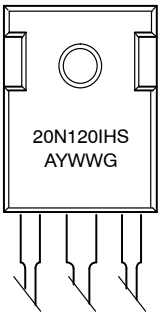
TO−247
CASE 340L
STYLE 4

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector−emitter voltage	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}	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}	I_{FM}	120	A
Gate−emitter voltage	V_{GE}	±20	V
Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 156 62.5	W
Operating junction temperature range	T_J	−55 to +150	°C
Storage temperature range	T_{stg}	−55 to +150	°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.

MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping
NGTB20N120IHSWG	TO−247 (Pb−Free)	30 Units / Rail

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THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.80	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	2.0	°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 = 500 μA	$V_{(BR)CES}$	1200	–	–	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 20 A V_{GE} = 15 V, I_C = 20 A, T_J = 150°C	V_{CEsat}	– –	2.10 2.5	2.4 –	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 50 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 = 150°C	I_{CES}	– –	– –	0.5 2.0	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}	–	3600	–	pF
Output capacitance		C_{oes}	–	90	–	
Reverse transfer capacitance		C_{res}	–	65	–	
Gate charge total	V_{CE} = 600 V, I_C = 20 A, V_{GE} = 15 V	Q_g	–	155	–	nC
Gate to emitter charge		Q_{ge}	–	30	–	
Gate to collector charge		Q_{gc}	–	70	–	
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	$t_{d(off)}$	–	160	–	ns
Fall time		t_f	–	160	–	
Turn−off switching loss		E_{off}	–	0.65	–	mJ
Turn−off delay time	T_J = 125°C V_{CC} = 600 V, I_C = 20 A R_g = 10 Ω V_{GE} = 0 V/ 15V	$t_{d(off)}$	–	167	–	ns
Fall time		t_f	–	205	–	
Turn−off switching loss		E_{off}	–	1.20	–	mJ
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 20 A V_{GE} = 0 V, I_F = 20 A, T_J = 150°C	V_F	– –	1.55 1.65	1.75 –	V

TYPICAL CHARACTERISTICS

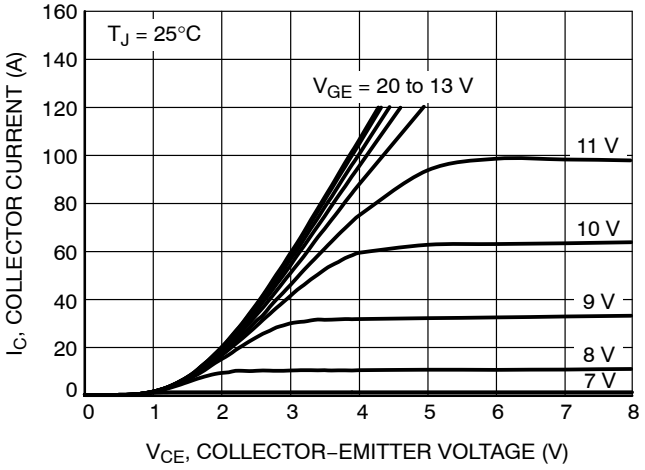


Figure 1. Output Characteristics

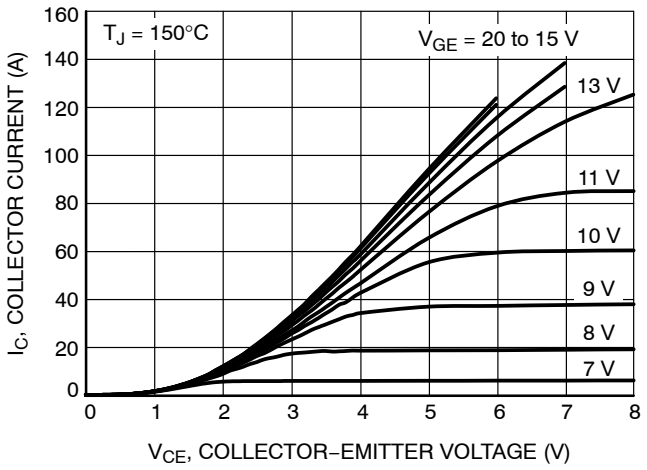


Figure 2. Output Characteristics

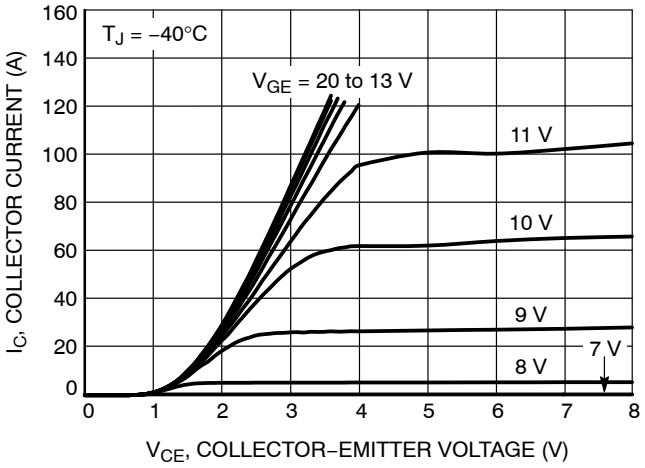


Figure 3. Output Characteristics

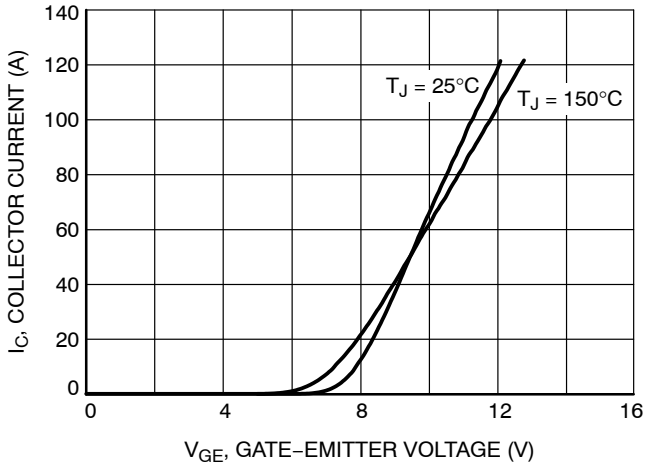


Figure 4. Typical Transfer Characteristics

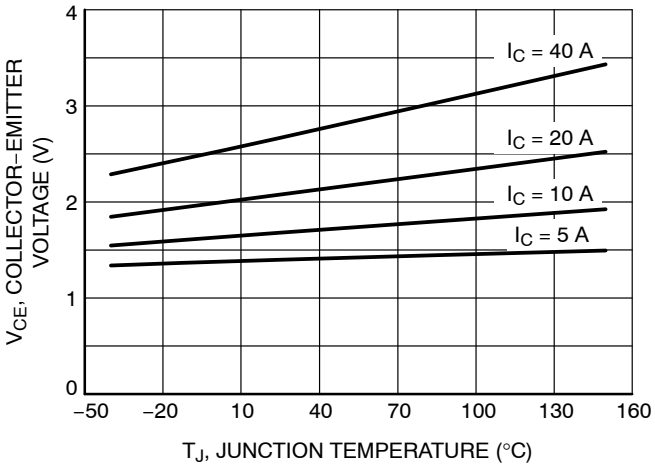


Figure 5. $V_{CE(sat)}$ vs. T_J

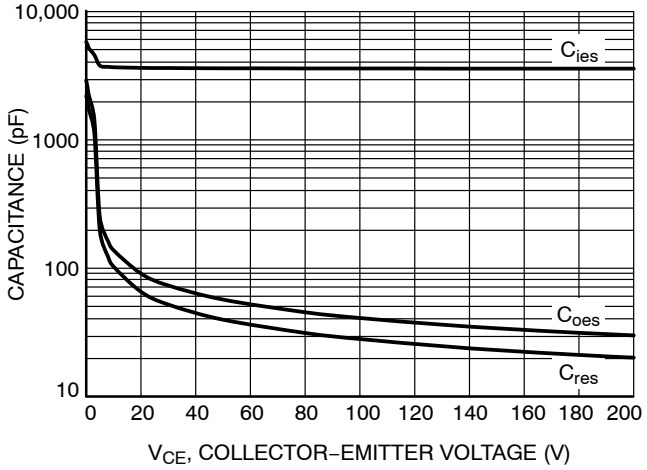


Figure 6. Typical Capacitance

TYPICAL CHARACTERISTICS

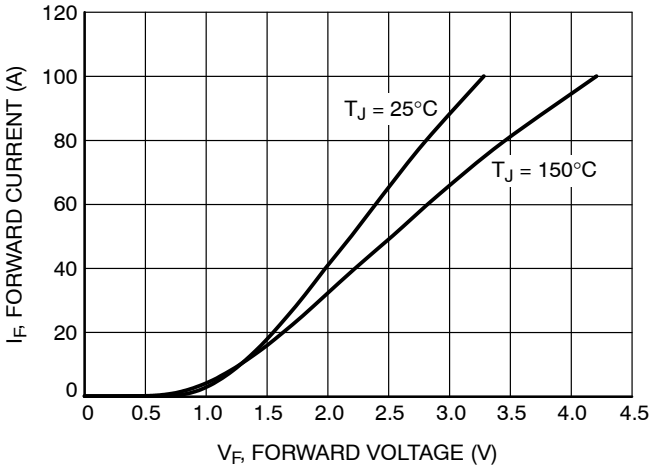


Figure 7. Diode Forward Characteristics

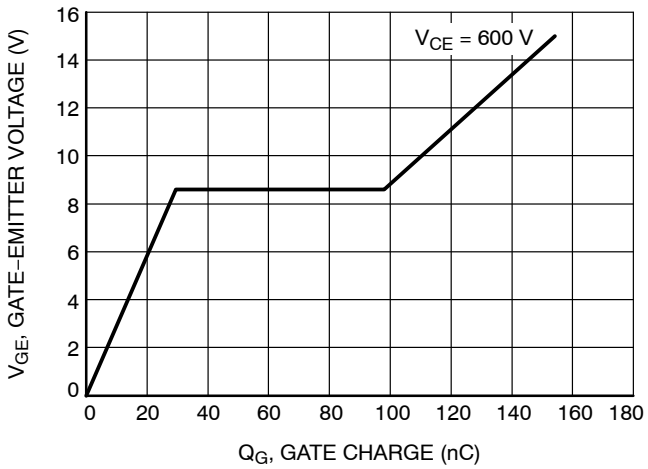


Figure 8. Typical Gate Charge

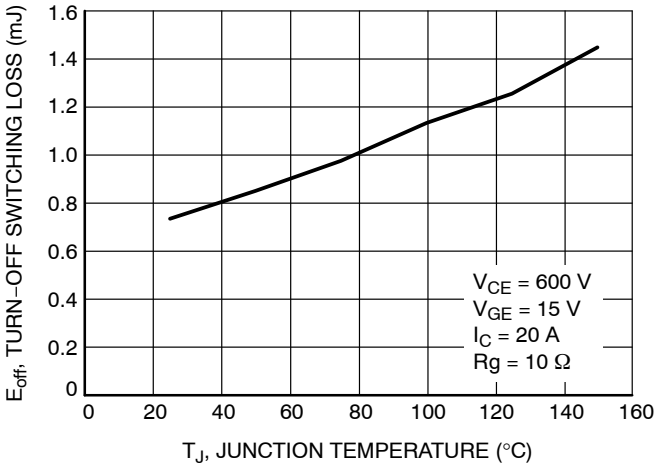


Figure 9. Switching Loss vs. Temperature

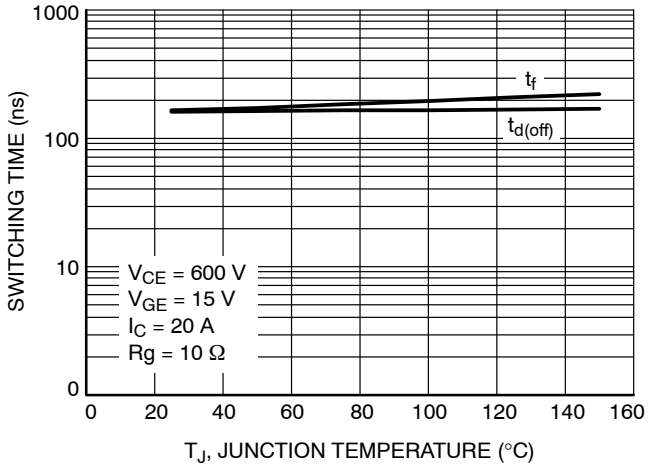


Figure 10. Switching Time vs. Temperature

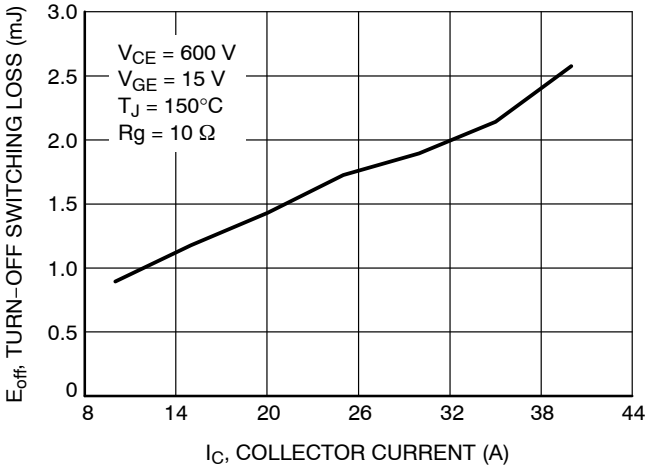


Figure 11. Switching Loss vs. I_C

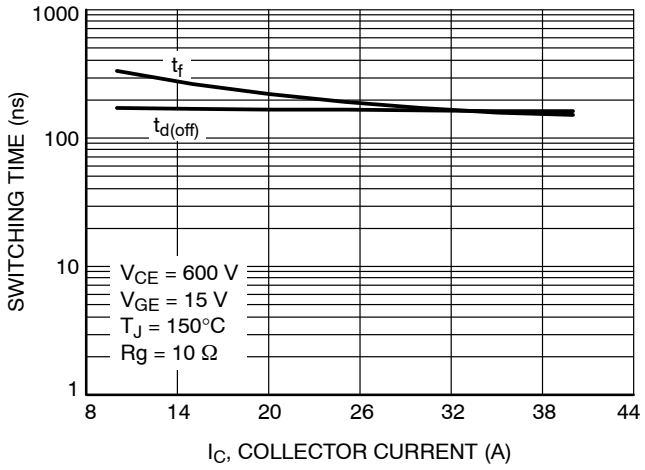


Figure 12. Switching Time vs. I_C

TYPICAL CHARACTERISTICS

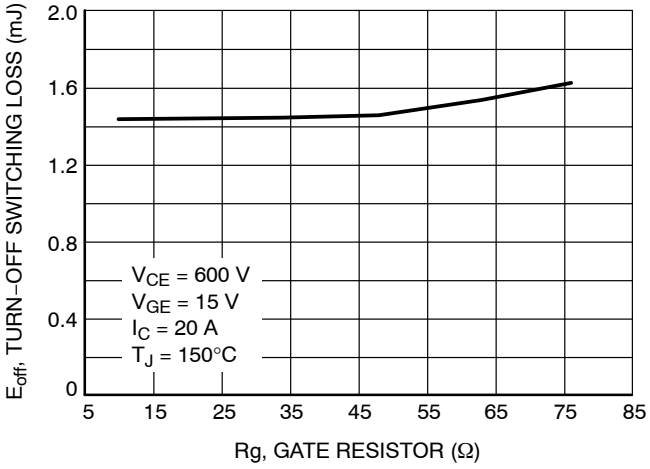


Figure 13. Switching Loss vs. Rg

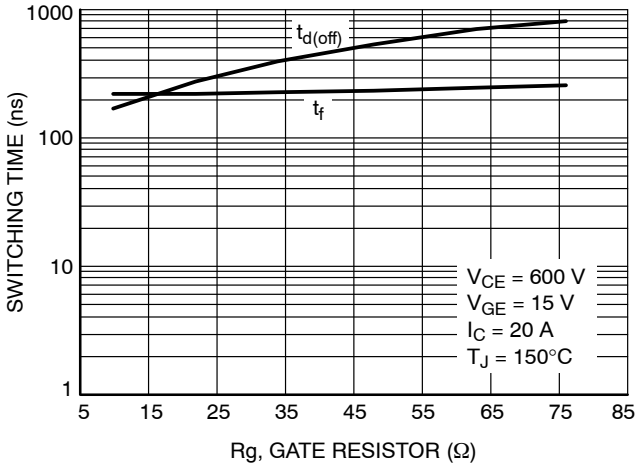


Figure 14. Switching Time vs. Rg

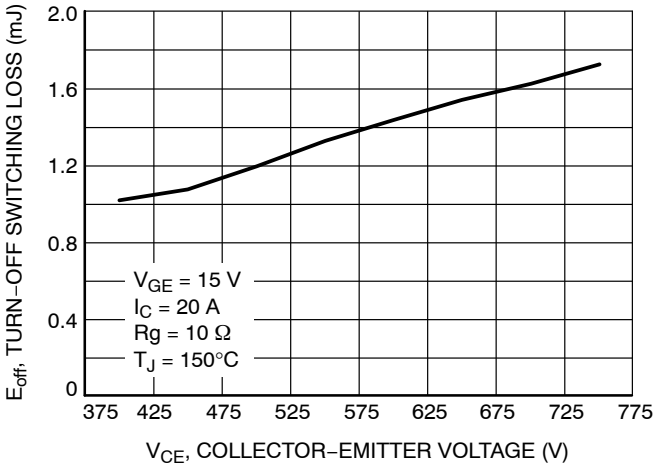


Figure 15. Switching Loss vs. V_{CE}

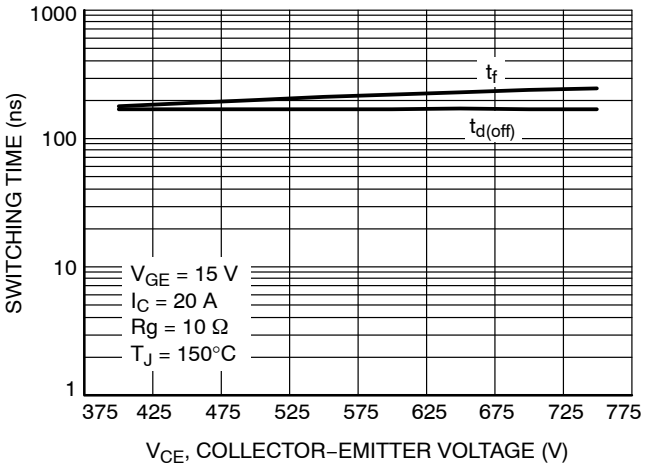


Figure 16. Switching Time vs. V_{CE}

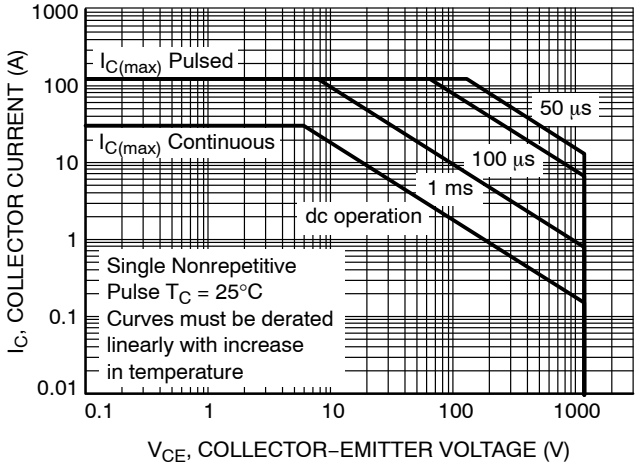


Figure 17. Safe Operating Area

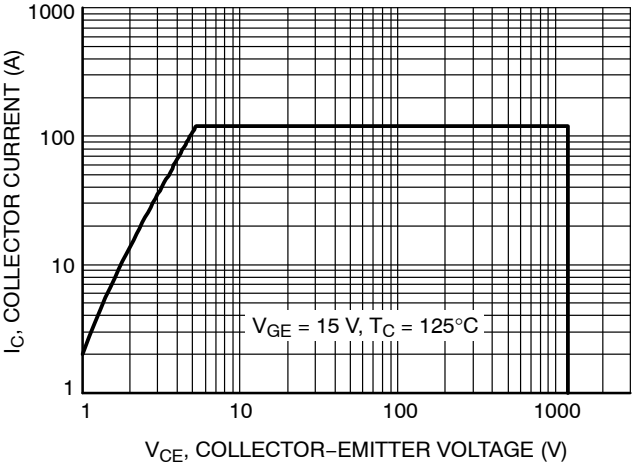
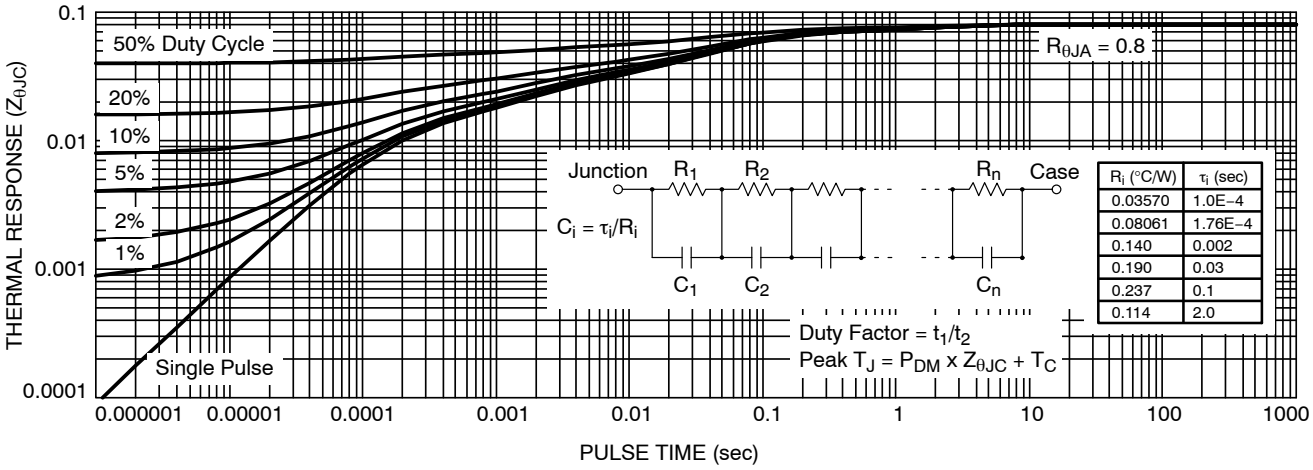


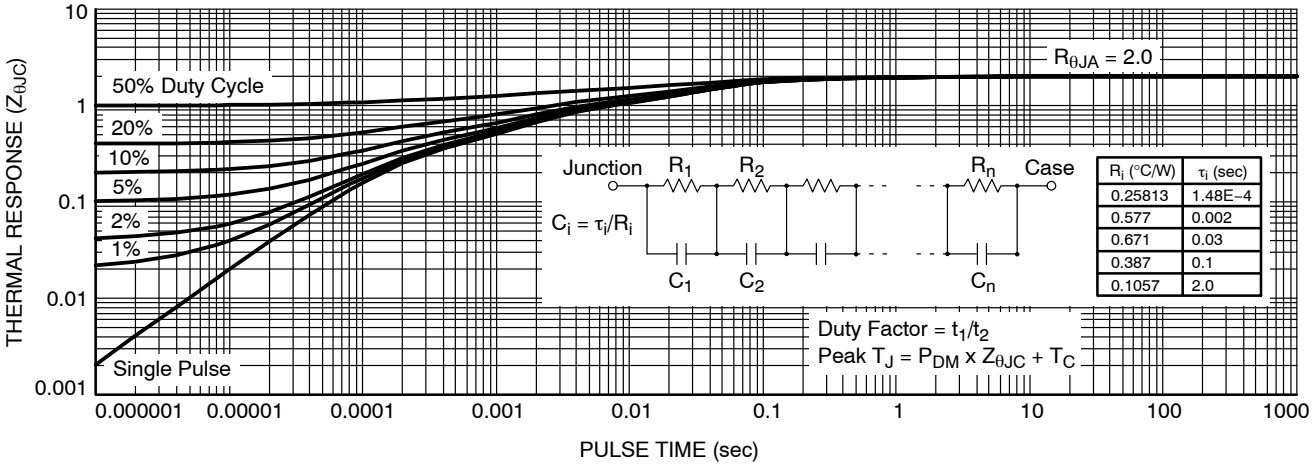
Figure 18. Reverse Bias Safe Operating Area

TYPICAL CHARACTERISTICS



R_i (°C/W)	τ_i (sec)
0.03570	1.0E−4
0.08061	1.76E−4
0.140	0.002
0.190	0.03
0.237	0.1
0.114	2.0

Figure 19. IGBT Transient Thermal Impedance



R_i (°C/W)	τ_i (sec)
0.25813	1.48E−4
0.577	0.002
0.671	0.03
0.387	0.1
0.1057	2.0

Figure 20. Diode Transient Thermal Impedance

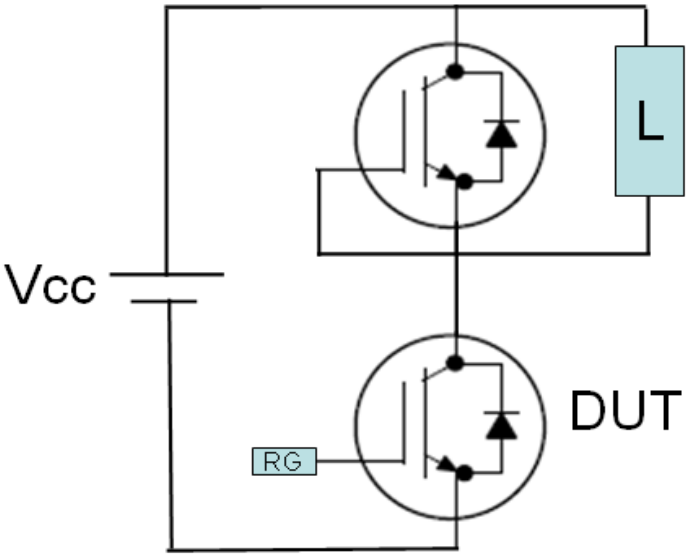


Figure 21. Test Circuit for Switching Characteristics

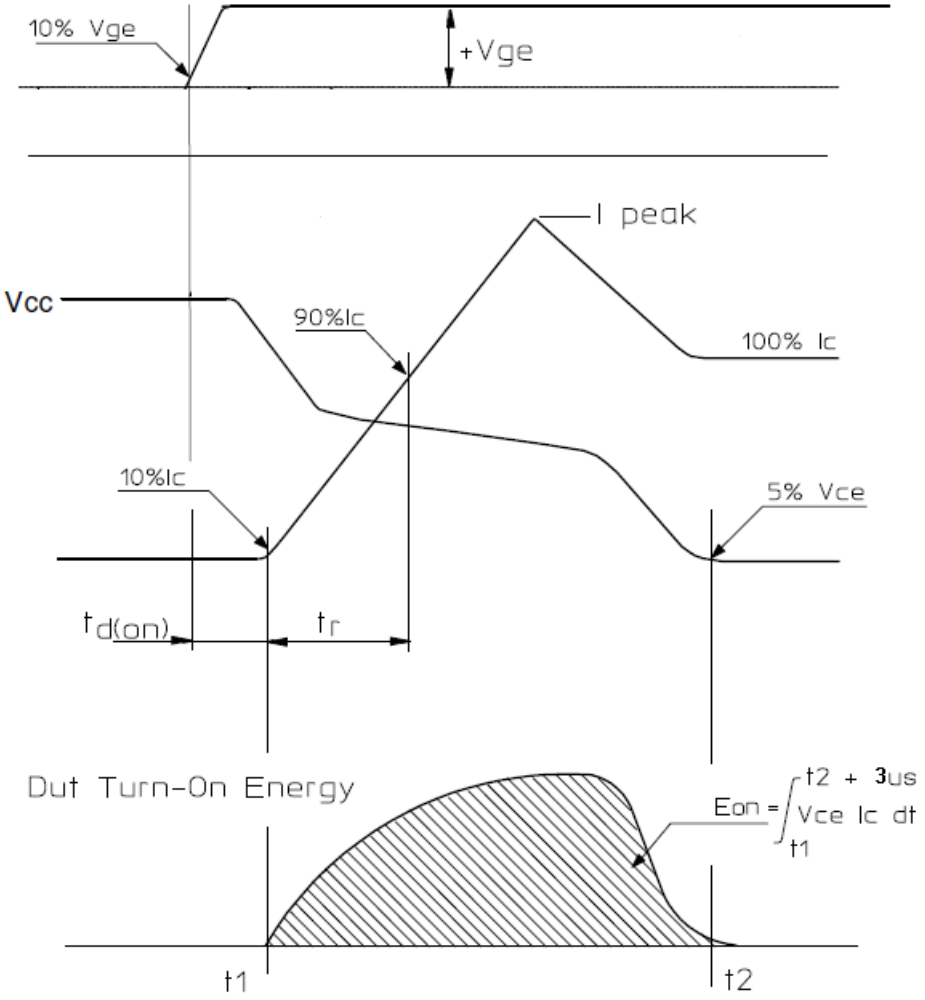


Figure 22. Definition of Turn On Waveform

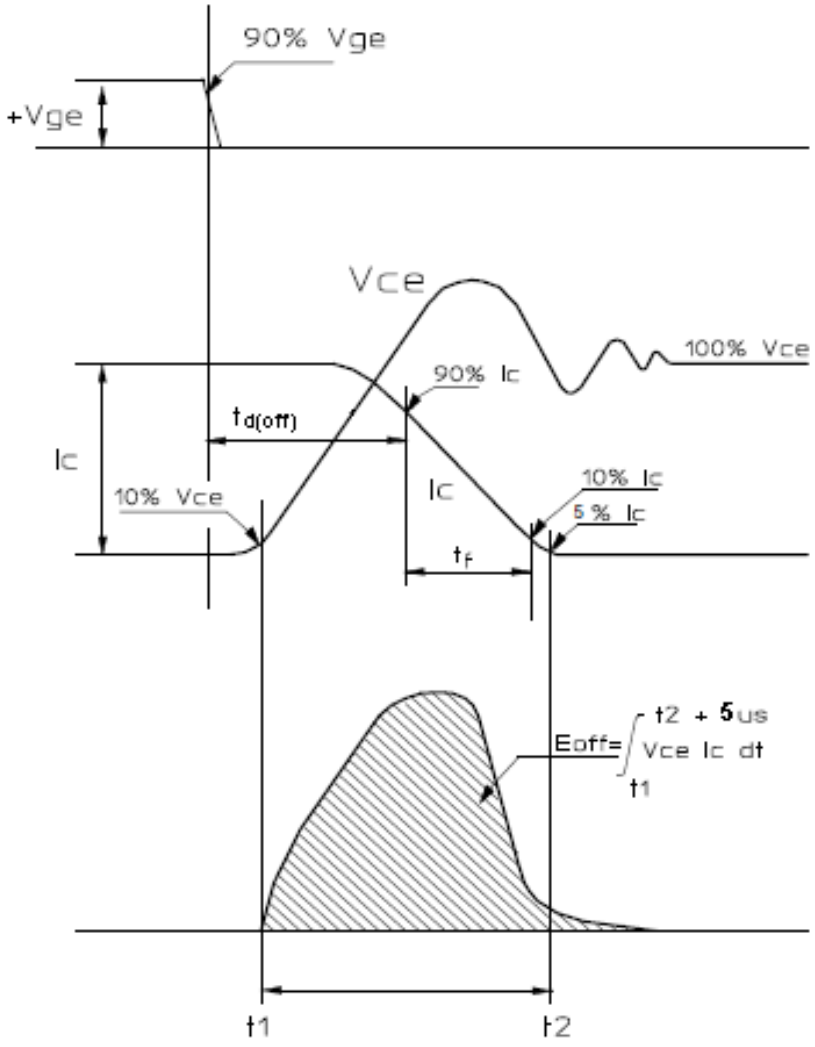
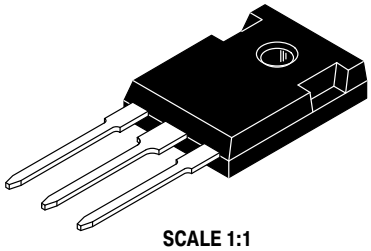


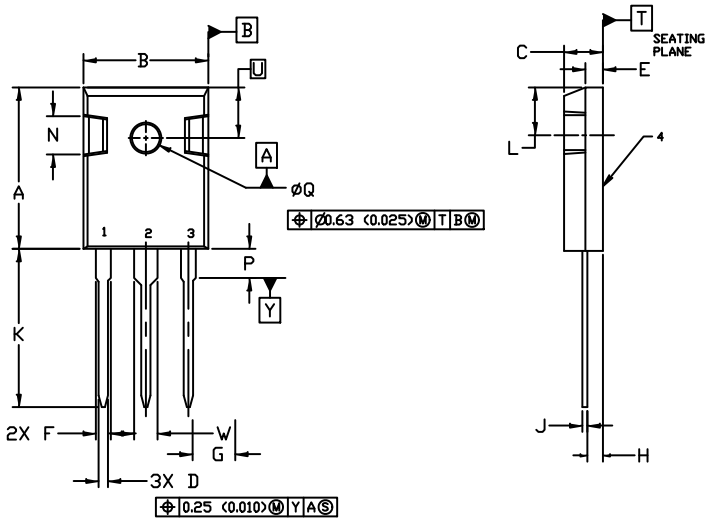
Figure 23. Definition of Turn Off Waveform



TO−247
CASE 340L
ISSUE G

DATE 06 OCT 2021

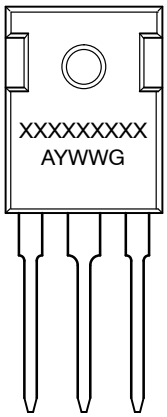
SCALE 1:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER

	MILLIMETERS		INCHES	
DIM	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*



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

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

*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. Some products may not follow the Generic Marking.

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DESCRIPTION:	TO−247	PAGE 1 OF 1

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