IGBT with Monolithic Free Wheeling Diode

NGTB30N140IHR3WG

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective ultra Field Stop (FS) Trench construction and provides superior performance. It is especially designed for low on−state and is well suited for resonant or soft switching topologies, such as those used in inductive heating applications. The device contains a reverse conducting diode integrated on the same die, which makes the device construction very cost effective.

Features

- Extremely Efficient Trench with Ultra Field Stop Technology
- 1400 V Breakdown Voltage
- 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}	1400	V
Collector current @ T_C = 25°C @ T_C = 100°C	I_C	 60 30	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	 60 30	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	 357 178	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 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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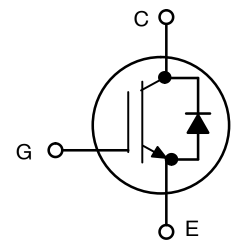
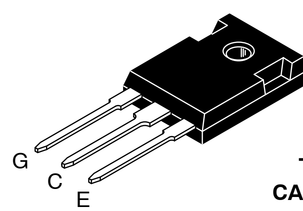
30 A, 1400 V
V_{CEsat} = 1.8 V
E_{off} = 1.05 mJ





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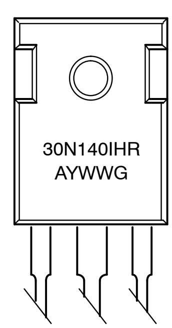
CASE 340AL

MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping
NGTB30N140IHR3WG	TO−247 (Pb−Free)	30 Units / Rail

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case	$R_{\theta JC}$	0.42	°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 = 1 mA	$V_{(BR)CES}$	1400	–	–	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 30 A V_{GE} = 15 V, I_C = 30 A, T_J = 175°C	V_{CEsat}	– –	1.80 2.43	1.95 –	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 175 μA	$V_{GE(th)}$	4.5	5.7	6.5	V
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 1400 V V_{GE} = 0 V, V_{CE} = 1400 V, T_J = 175°C	I_{CES}	– –	– –	20 1000	μA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	120	nA
DYNAMIC CHARACTERISTIC						
Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	3505	–	pF
Output capacitance		C_{oes}	–	70	–	
Reverse transfer capacitance		C_{res}	–	58	–	
Gate charge total	V_{CE} = 600 V, I_C = 30 A, V_{GE} = 15 V	Q_g	–	163	–	nC
Gate to emitter charge		Q_{ge}	–	30	–	
Gate to collector charge		Q_{gc}	–	81	–	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−off delay time	T_J = 25°C, V_{CC} = 600 V, I_C = 30 A, R_g = 10 Ω V_{GE} = −1.5V to +15 V	$t_{d(off)}$	–	197	–	ns
Fall time		t_f	–	122	–	
Turn−off switching loss		E_{off}	–	1.05	–	mJ
Turn−off delay time	T_J = 150°C, V_{CC} = 600 V, I_C = 30 A, R_g = 10 Ω V_{GE} = 15 V	$t_{d(off)}$	–	209	–	ns
Fall time		t_f	–	214	–	
Turn−off switching loss		E_{off}	–	1.75	–	mJ
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 30 A V_{GE} = 0 V, I_F = 30 A, T_J = 175°C	V_F	– –	1.90 2.48	2.10 –	V

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.

TYPICAL CHARACTERISTICS

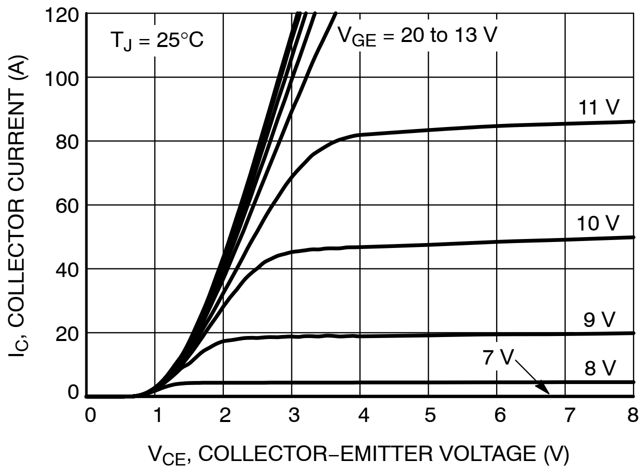


Figure 1. Output Characteristics

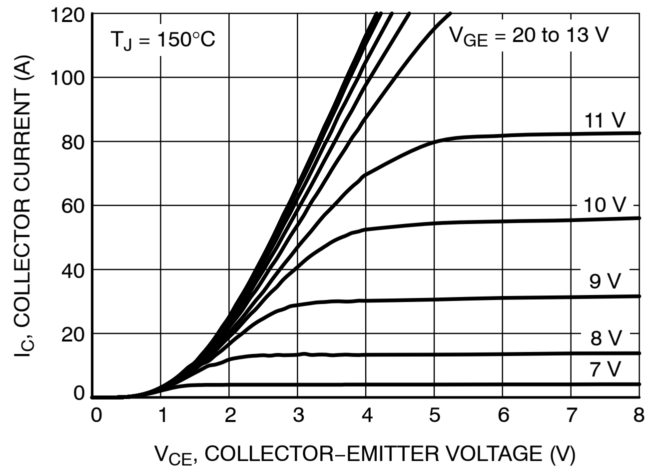


Figure 2. Output Characteristics

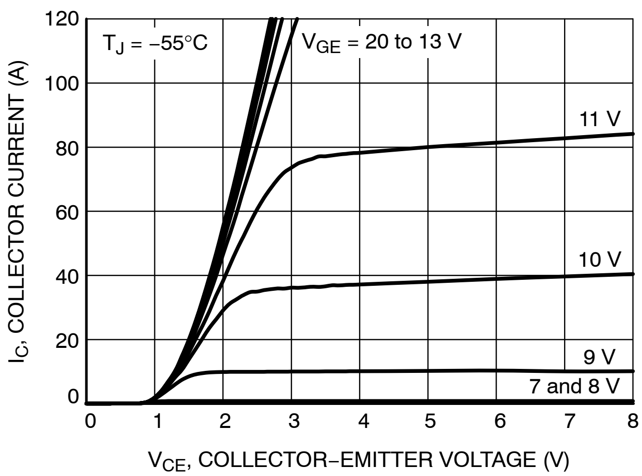


Figure 3. Output Characteristics

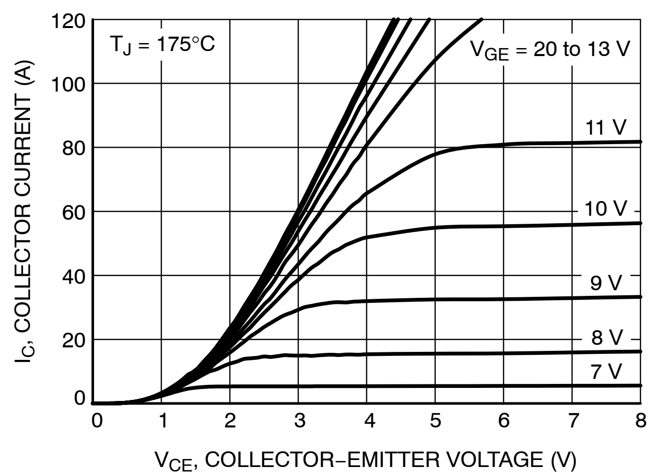


Figure 4. Output Characteristics

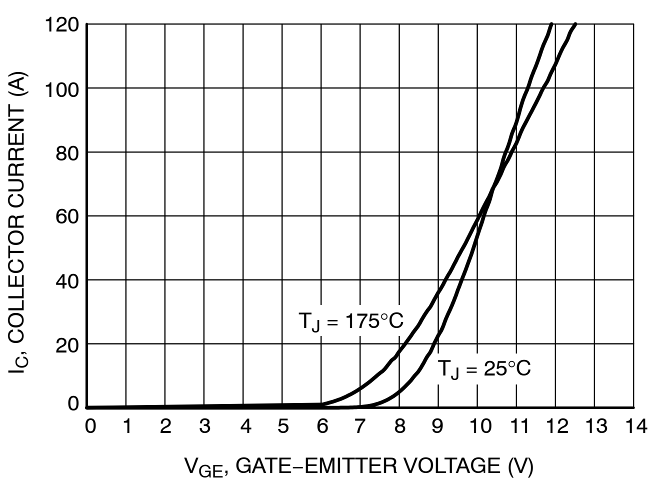


Figure 5. Typical Transfer Characteristics

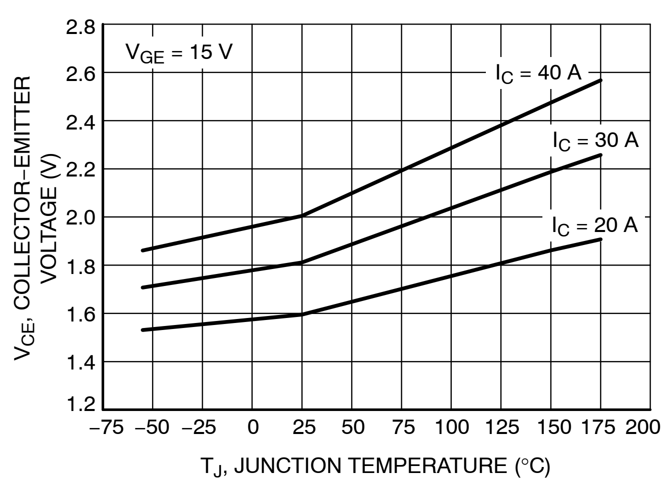


Figure 6. $V_{CE(sat)}$ vs. T_J

TYPICAL CHARACTERISTICS

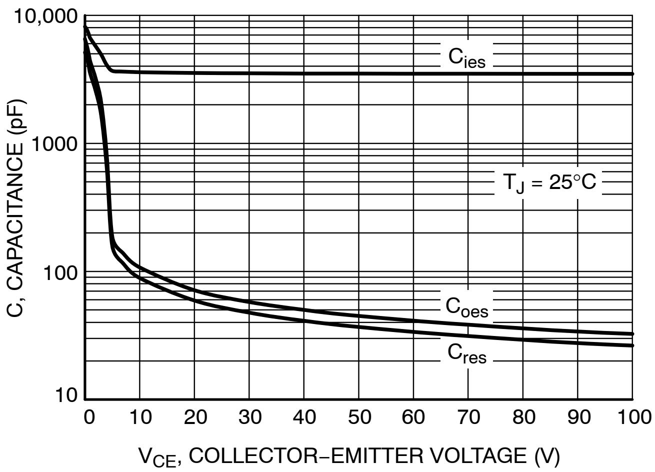


Figure 7. Typical Capacitance

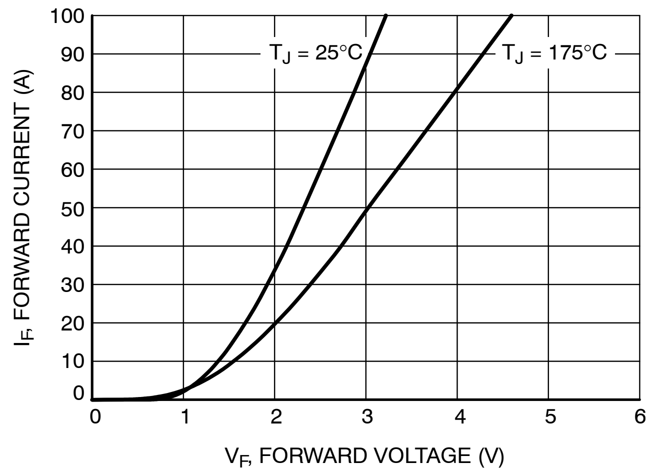


Figure 8. Diode Forward Characteristics

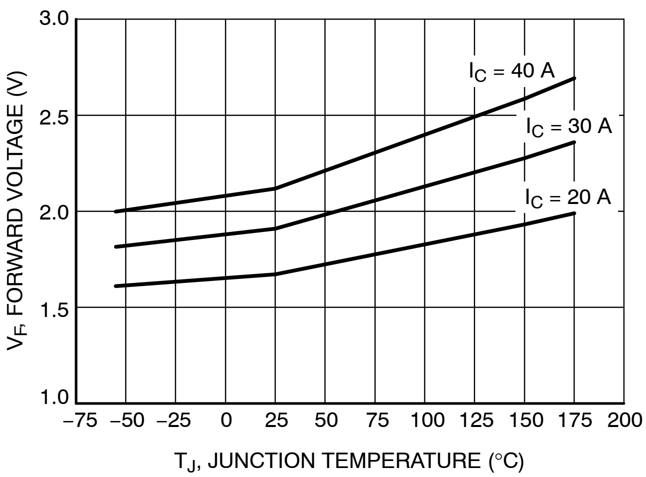


Figure 9. V_F vs. T_J

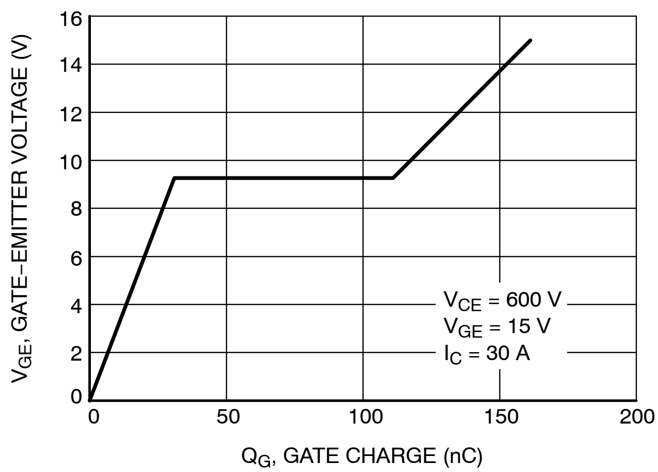


Figure 10. Typical Gate Charge

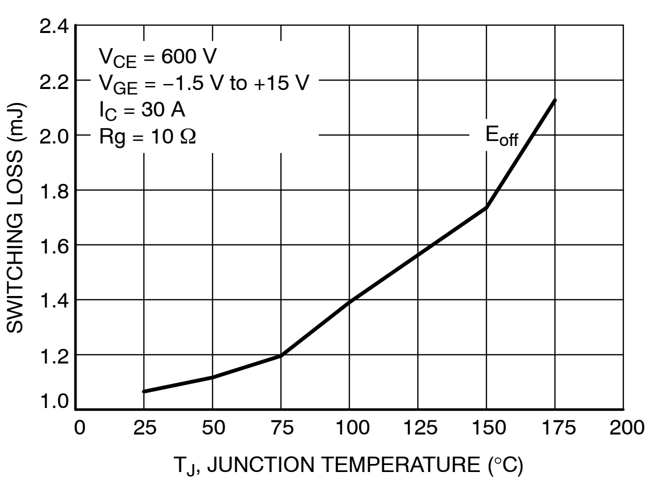


Figure 11. Switching Loss vs. Temperature

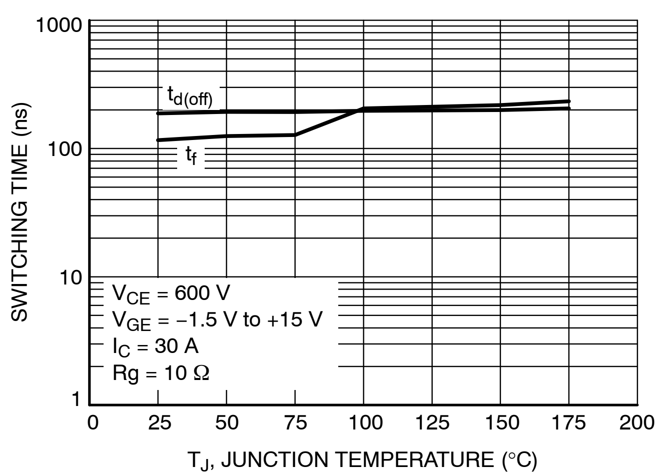


Figure 12. Switching Loss vs. Temperature

TYPICAL CHARACTERISTICS

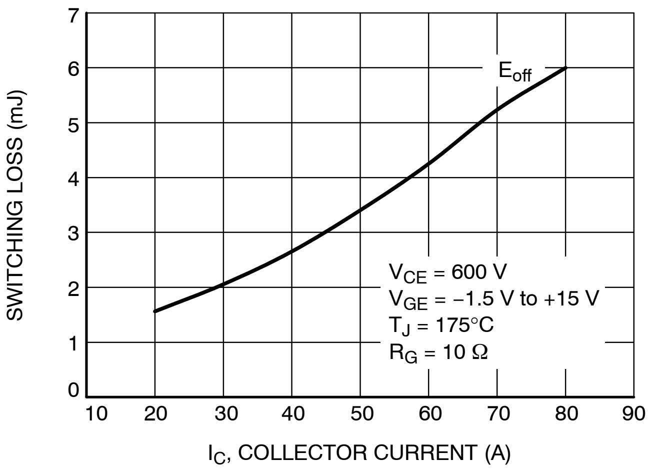


Figure 13. Switching Loss vs. I_C

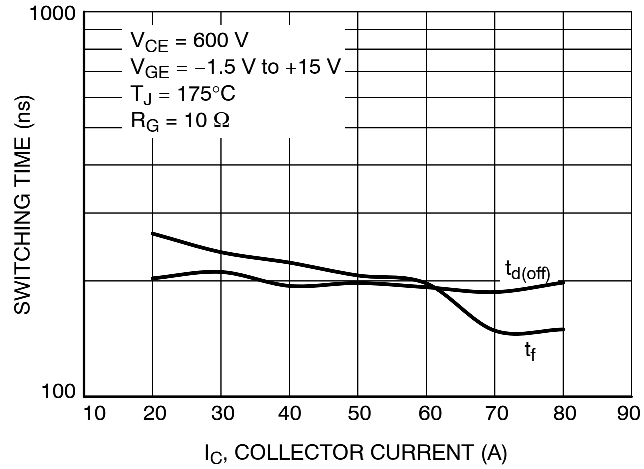


Figure 14. Switching Time vs. I_C

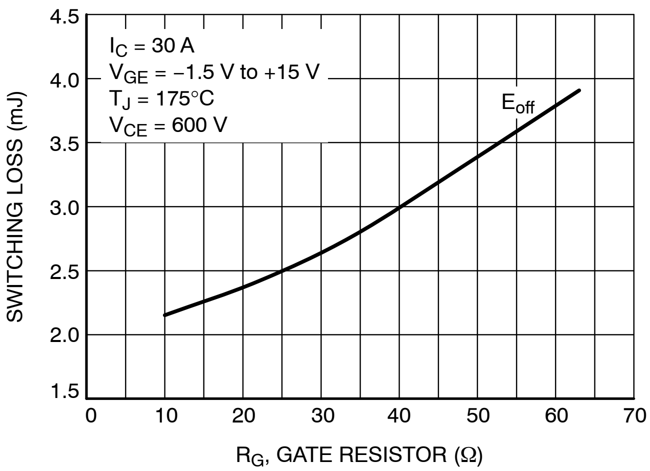


Figure 15. Switching Loss vs. Gate Resistor

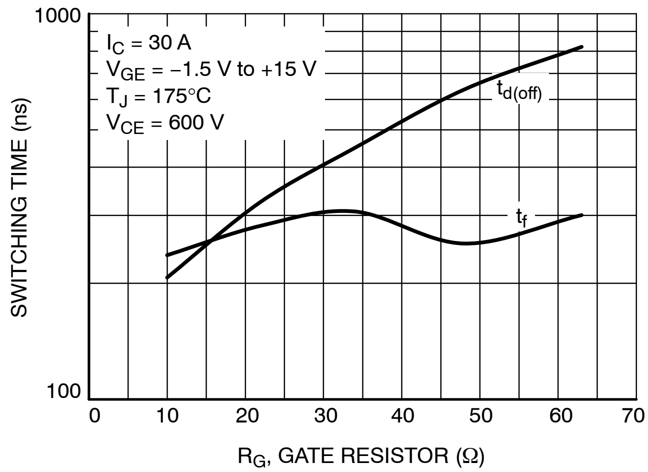


Figure 16. Switching Time vs. Gate Resistor

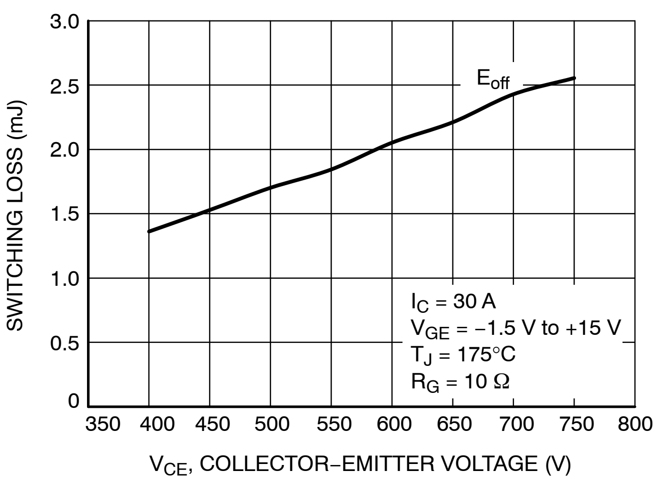


Figure 17. Switching Loss vs. V_{CE}

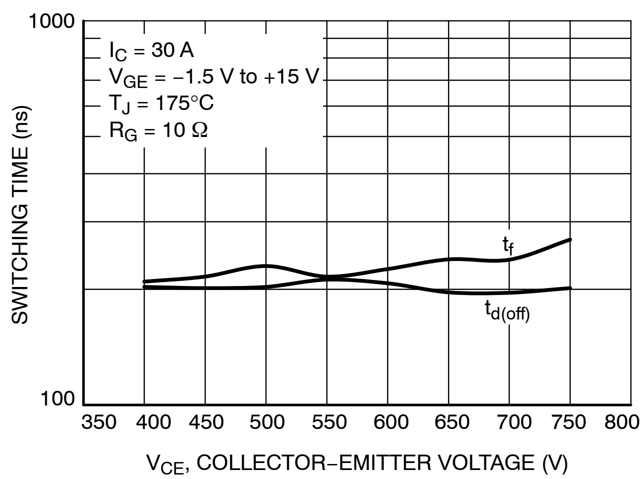


Figure 18. Switching Time vs. V_{CE}

TYPICAL CHARACTERISTICS

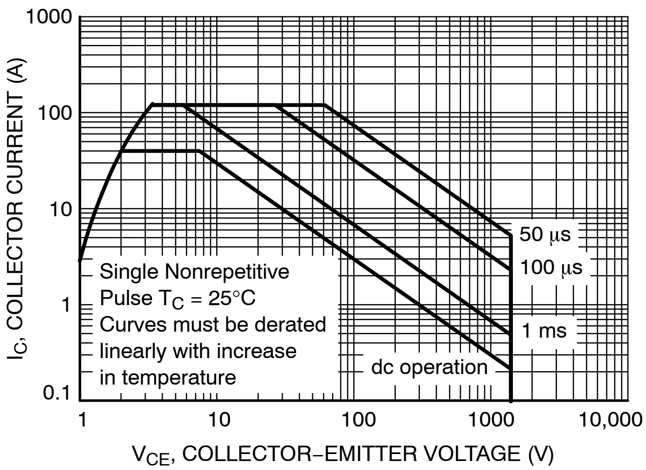


Figure 19. Safe Operating Area

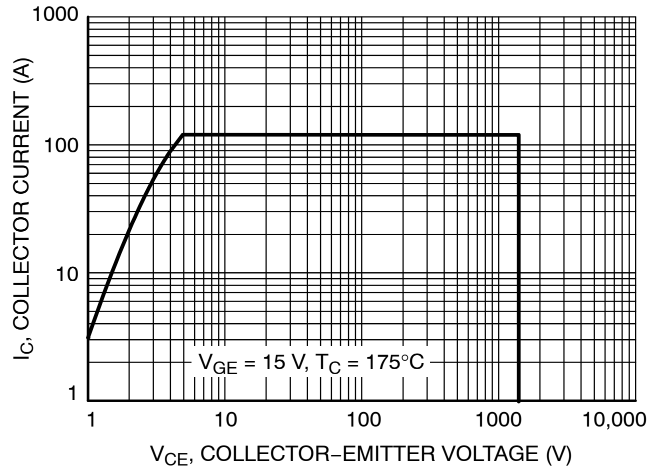


Figure 20. Reverse Bias Safe Operating Area

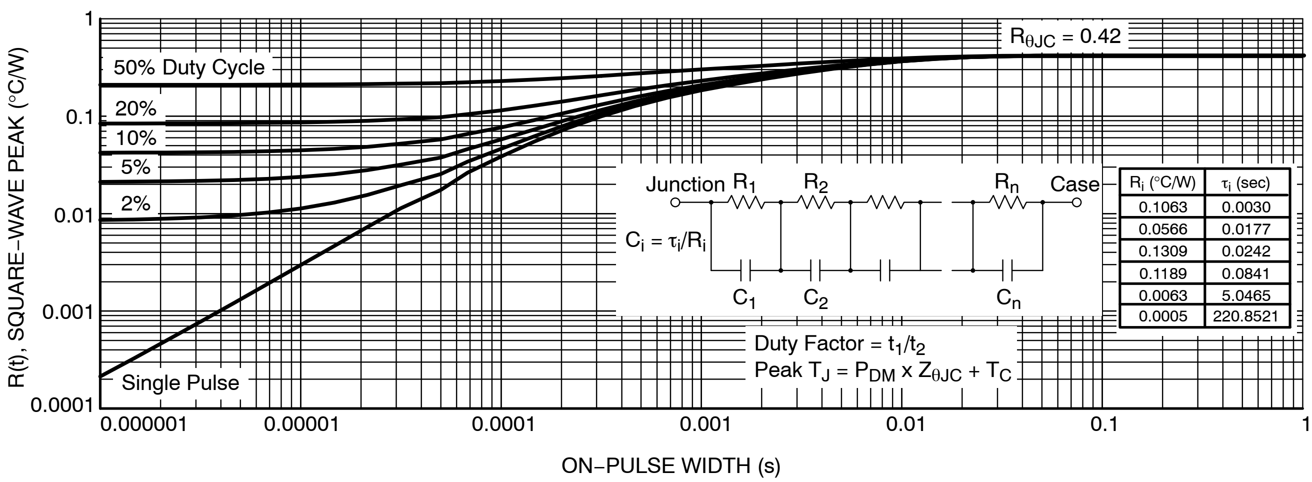


Figure 21. IGBT Transient Thermal Impedance

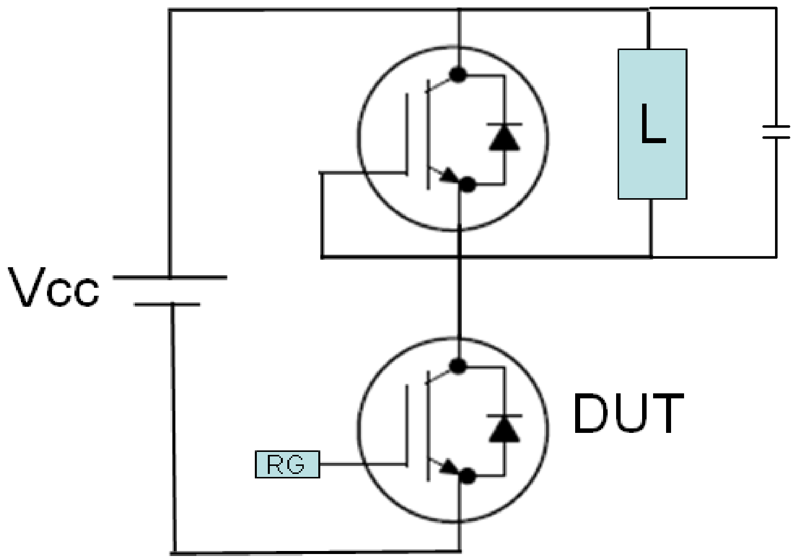


Figure 22. Test Circuit for Switching Characteristics

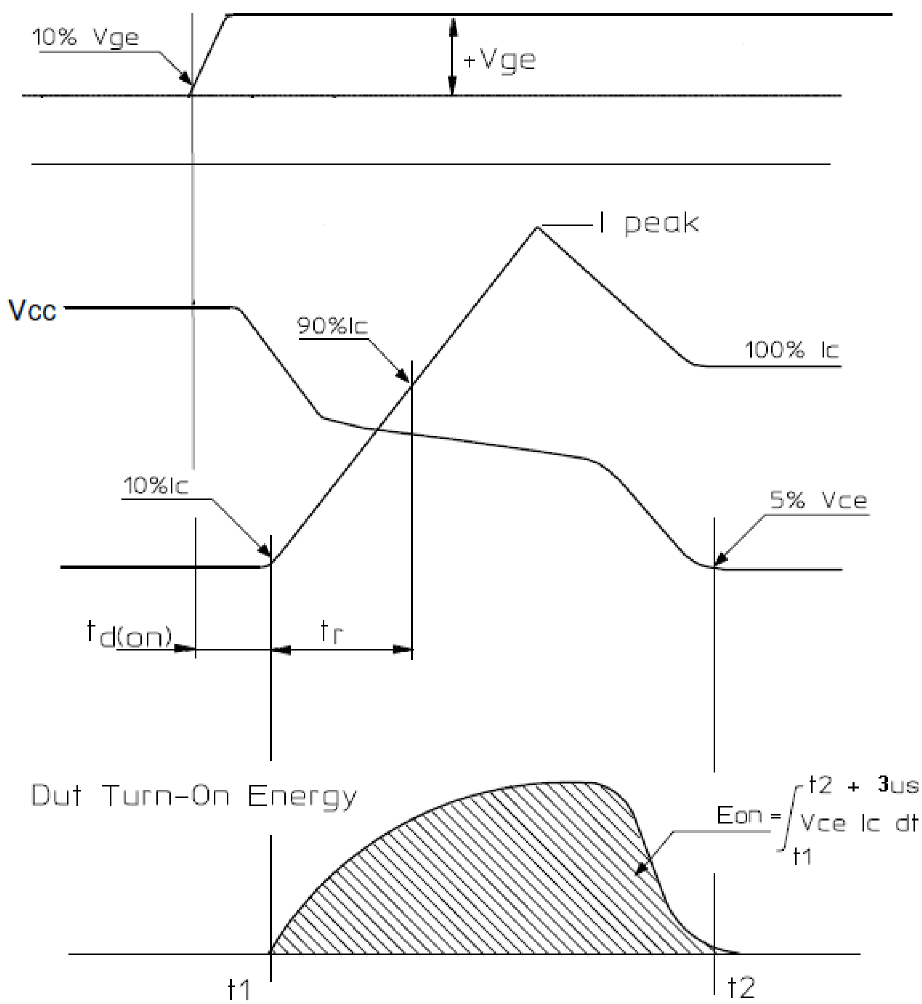


Figure 23. Definition of Turn On Waveform

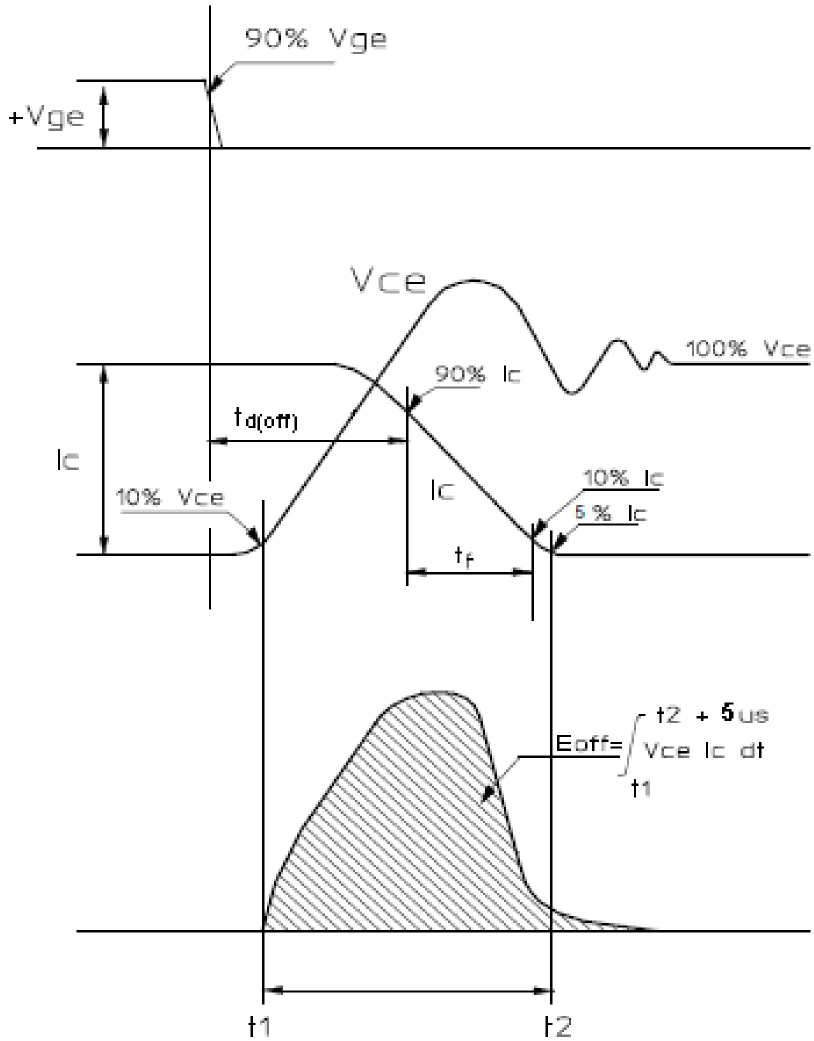


Figure 24. Definition of Turn Off Waveform

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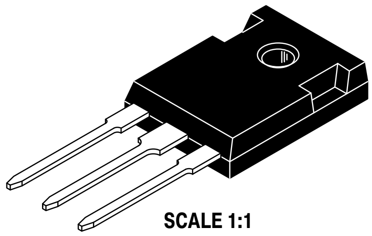
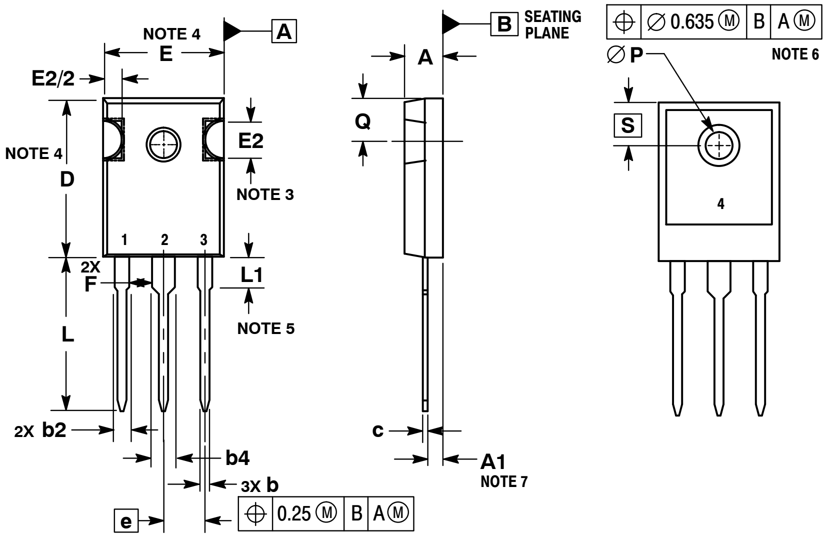


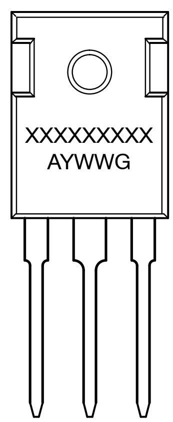
SCALE 1:1



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	1.07	1.33
b2	1.65	2.35
b4	2.60	3.40
c	0.45	0.68
D	20.80	21.34
E	15.50	16.25
E2	4.32	5.49
e	5.45 BSC	
F	2.655	---
L	19.80	20.80
L1	3.81	4.32
P	3.55	3.65
Q	5.40	6.20
S	6.15 BSC	

GENERIC MARKING DIAGRAM*



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.

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DESCRIPTION:	TO−247	PAGE 1 OF 1

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