NGTB30N60FWG

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.

Features

- Optimized for Very Low V_{CEsat}
- Low Switching Loss Reduces System Power Dissipation
- Soft Fast Reverse Recovery Diode
- 5 μs Short−Circuit Capability
- These are Pb−Free Devices

Typical Applications

- Power Factor Correction

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector−emitter voltage	V_{CES}	600	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}	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}	I_{FM}	120	A
Short−circuit withstand time V_{GE} = 15 V, V_{CE} = 300 V, $T_J \leq$ +150°C	t_{SC}	5	μs
Gate−emitter voltage Transient Gate Emitter Voltage (t_p = 5 μs, D < 0.010)	V_{GE}	±20 ±30	V
Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 167 67	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.

ON Semiconductor®

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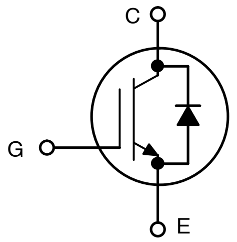
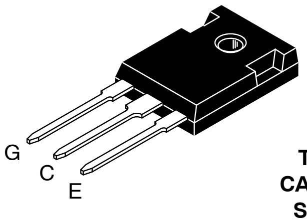
30 A, 600 V

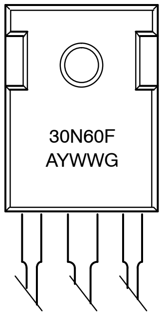
V_{CEsat} = 1.45 V





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
NGTB30N60FWG	TO−247 (Pb−Free)	30 Units / Rail

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.75	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	1.06	°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	$V_{(BR)CES}$	600	−	−	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 30 A V_{GE} = 15 V, I_C = 30 A, T_J = 150°C	V_{CEsat}	1.25 −	1.45 1.75	1.70 −	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 200 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} = 600 V V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150°C	I_{CES}	− −	− −	0.2 2	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}	−	4100	−	pF
Output capacitance		C_{oes}	−	150	−	
Reverse transfer capacitance		C_{res}	−	95	−	
Gate charge total	V_{CE} = 480 V, I_C = 30 A, V_{GE} = 15 V	Q_g		170		nC
Gate to emitter charge		Q_{ge}		34		
Gate to collector charge		Q_{gc}		83		
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 400 V, I_C = 30 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$		81		ns
Rise time		t_r		31		
Turn−off delay time		$t_{d(off)}$		190		
Fall time		t_f		110		
Turn−on switching loss		E_{on}		0.65		mJ
Turn−off switching loss		E_{off}		0.65		
Total switching loss		E_{ts}		1.30		
Turn−on delay time	T_J = 150°C V_{CC} = 400 V, I_C = 30 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$		80		ns
Rise time		t_r		32		
Turn−off delay time		$t_{d(off)}$		200		
Fall time		t_f		230		
Turn−on switching loss		E_{on}		0.80		mJ
Turn−off switching loss		E_{off}		1.1		
Total switching loss		E_{ts}		1.90		

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 30 A V_{GE} = 0 V, I_F = 30 A, T_J = 150°C	V_F	1.45	1.90	2.35	V
Reverse recovery time	T_J = 25°C I_F = 30 A, V_R = 200 V di_F/dt = 200 A/μs	t_{rr}		72		ns
Reverse recovery charge		Q_{rr}		15		μC
Reverse recovery current		I_{rrm}		6		A

TYPICAL CHARACTERISTICS

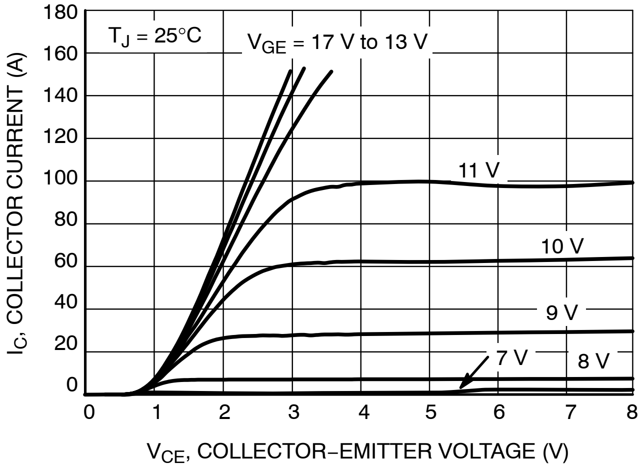


Figure 1. Output Characteristics

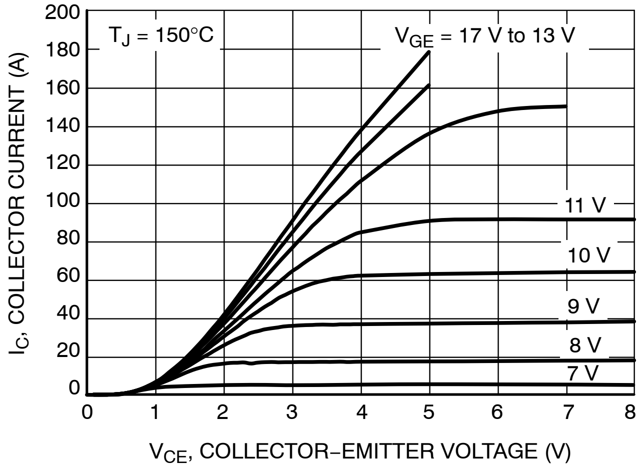


Figure 2. Output Characteristics

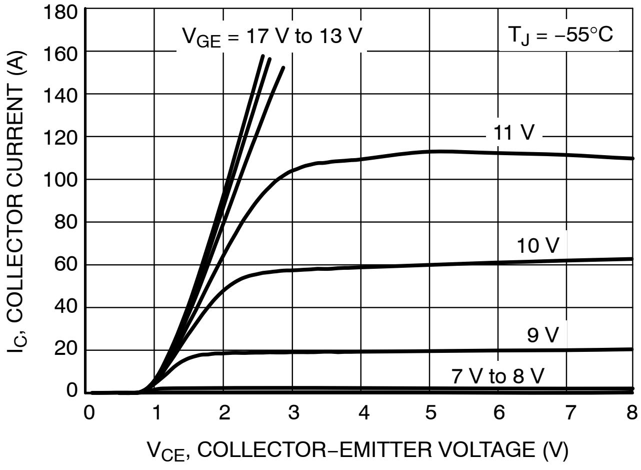


Figure 3. Output Characteristics

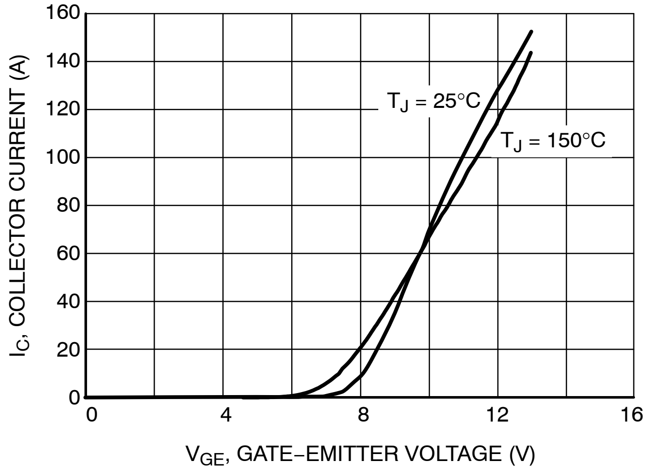


Figure 4. Typical Transfer Characteristics

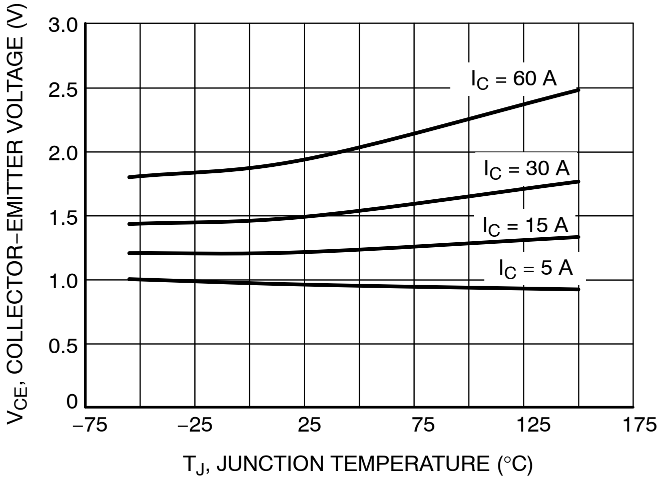


Figure 5. $V_{CE(sat)}$ vs. T_J

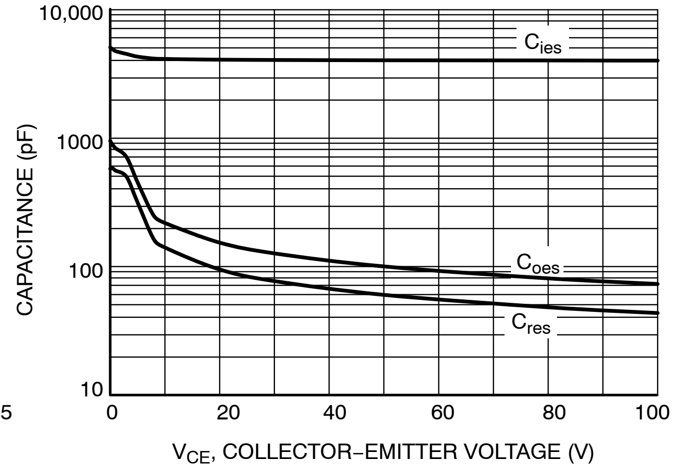


Figure 6. Typical Capacitance

TYPICAL CHARACTERISTICS

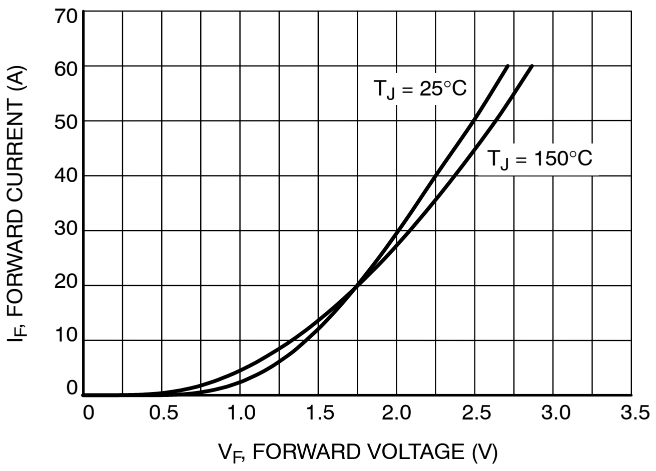


Figure 7. Diode Forward Characteristics

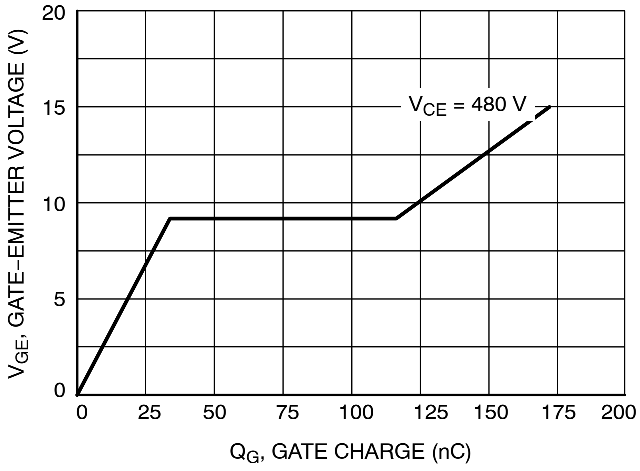


Figure 8. Typical Gate Charge

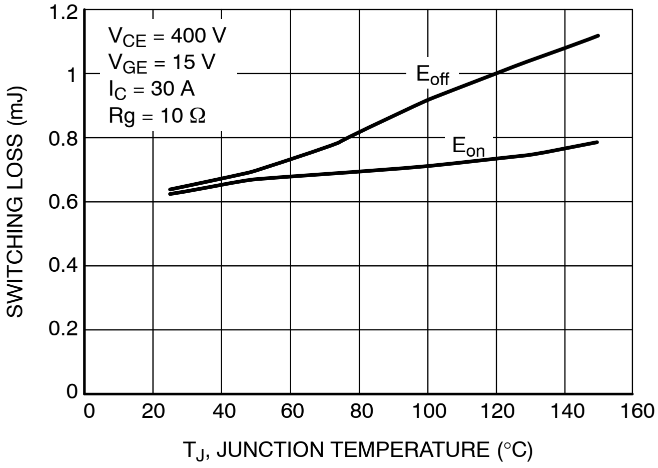


Figure 9. Switching Loss vs. Temperature

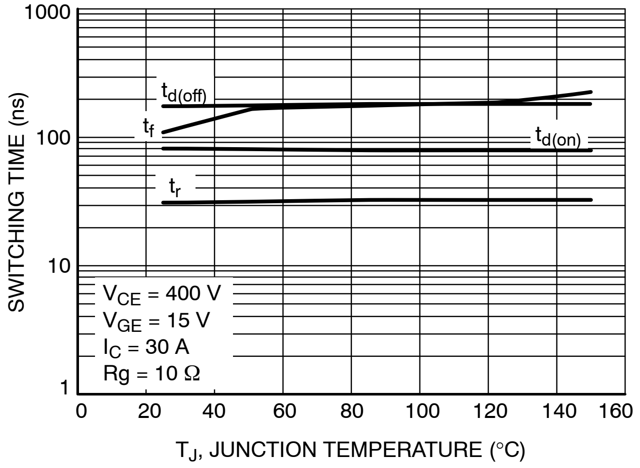


Figure 10. Switching Time vs. Temperature

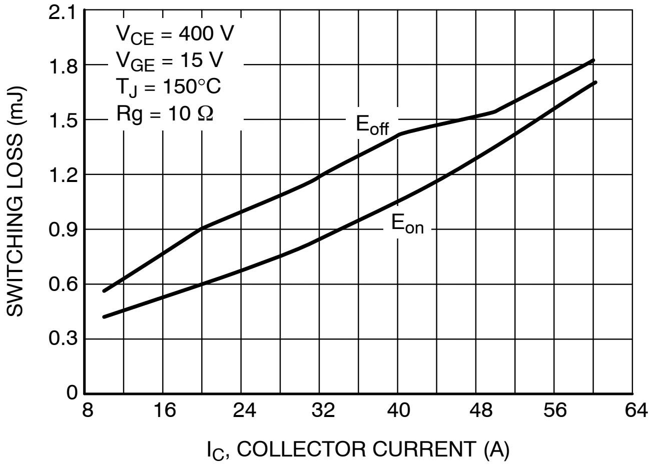


Figure 11. Switching Loss vs. I_C

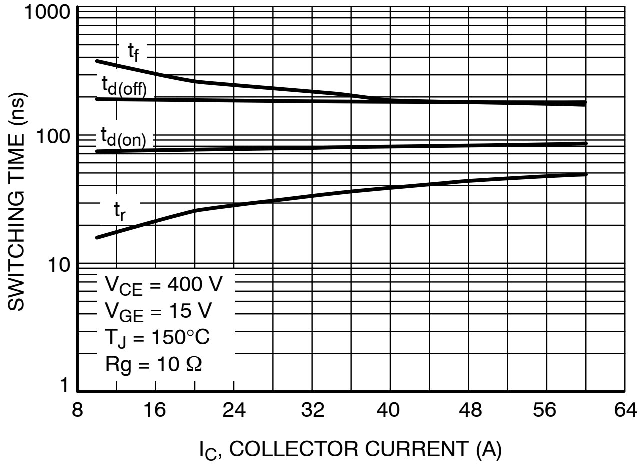


Figure 12. Switching Time vs. I_C

TYPICAL CHARACTERISTICS

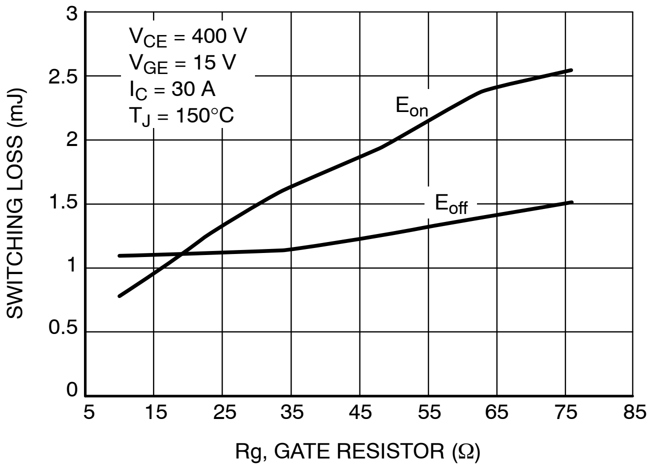


Figure 13. Switching Loss vs. Rg

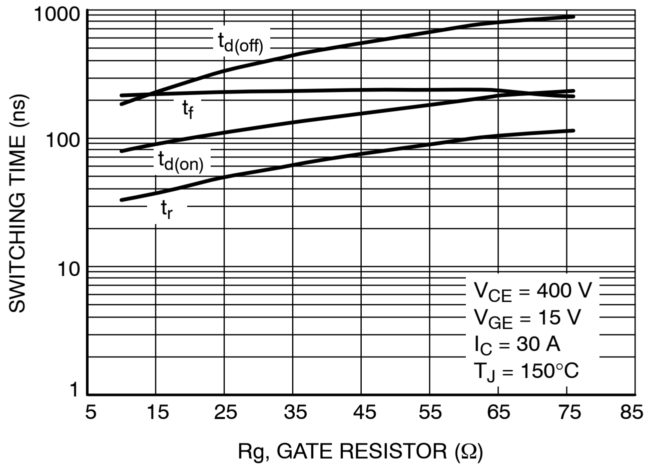


Figure 14. Switching Time vs. Rg

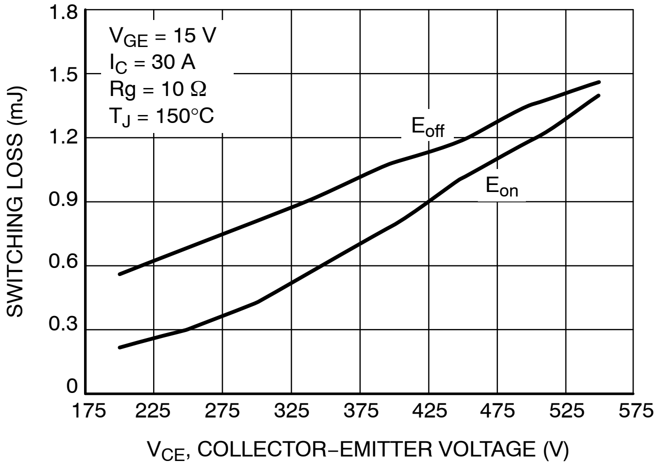


Figure 15. Switching Loss vs. V_{CE}

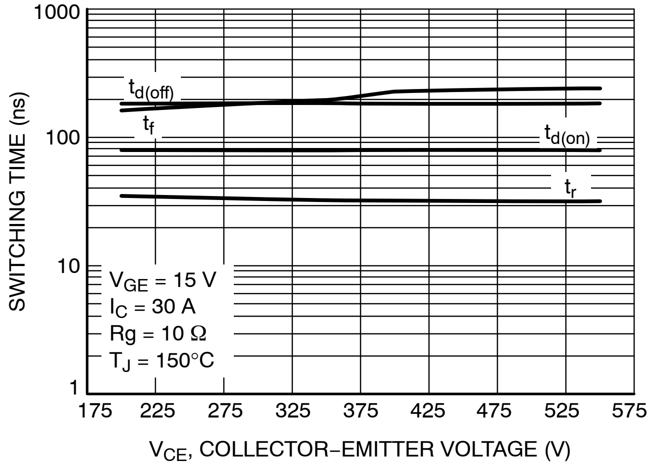


Figure 16. Switching Time vs. V_{CE}

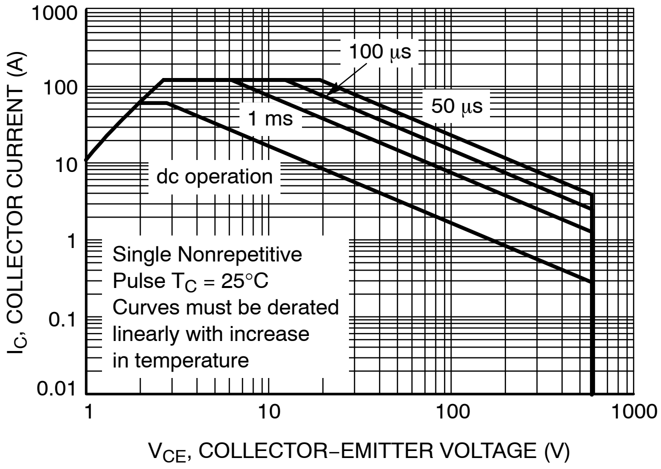


Figure 17. Safe Operating Area

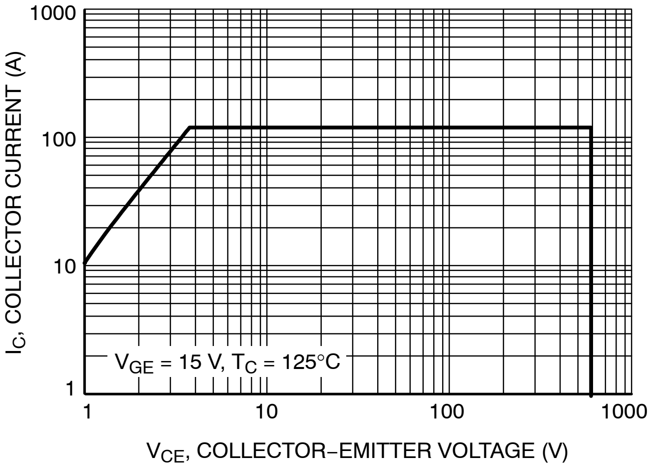
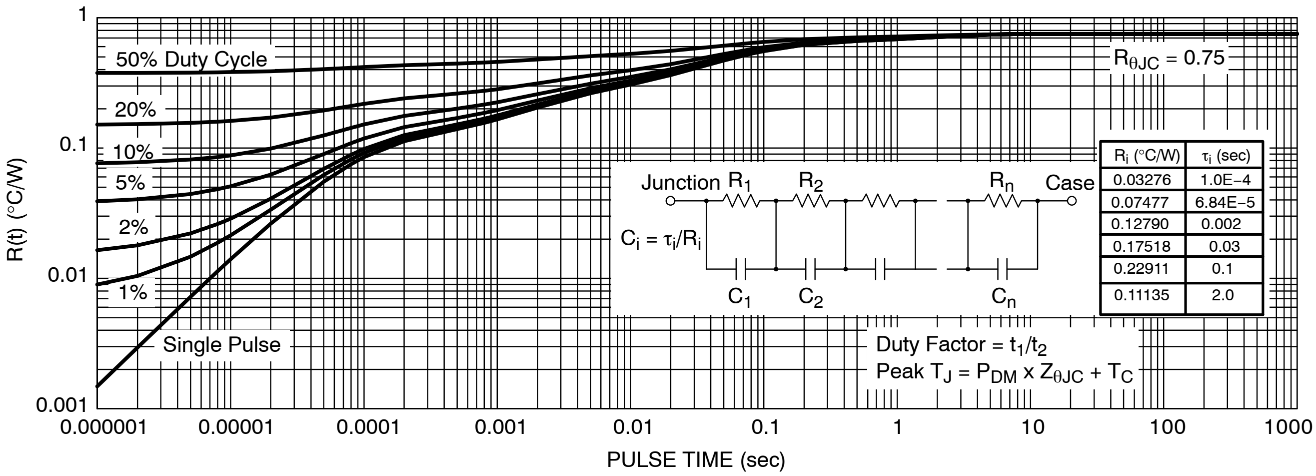


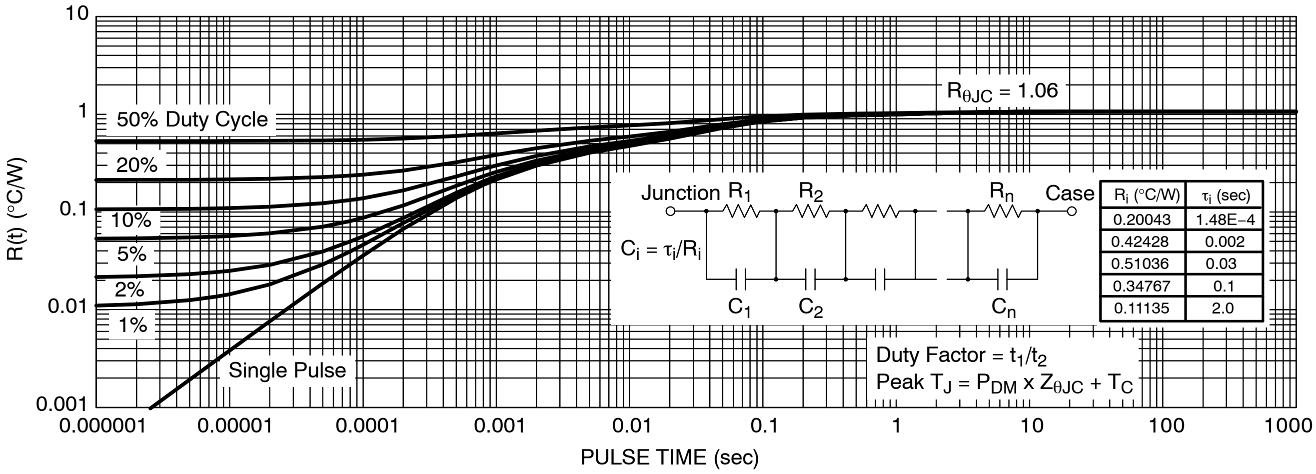
Figure 18. Reverse Bias Safe Operating Area

TYPICAL CHARACTERISTICS



R_i (°C/W)	τ_i (sec)
0.03276	1.0E−4
0.07477	6.84E−5
0.12790	0.002
0.17518	0.03
0.22911	0.1
0.11135	2.0

Figure 19. IGBT Transient Thermal Impedance



R_i (°C/W)	τ_i (sec)
0.20043	1.48E−4
0.42428	0.002
0.51036	0.03
0.34767	0.1
0.11135	2.0

Figure 20. Diode Transient Thermal Impedance

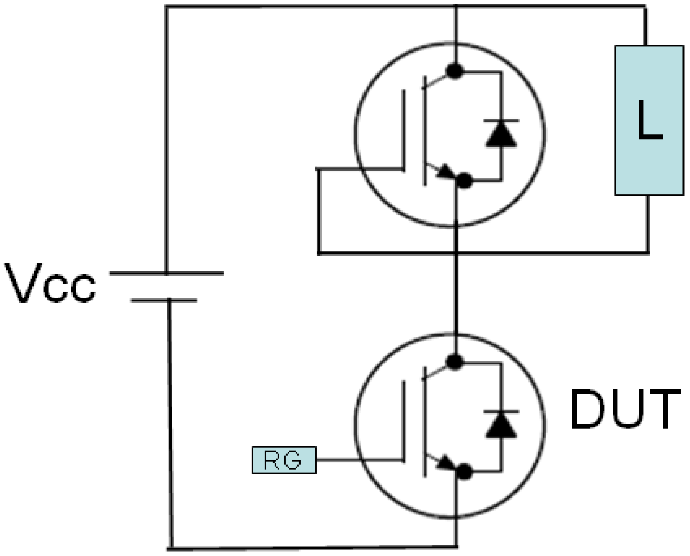


Figure 21. Test Circuit for Switching Characteristics

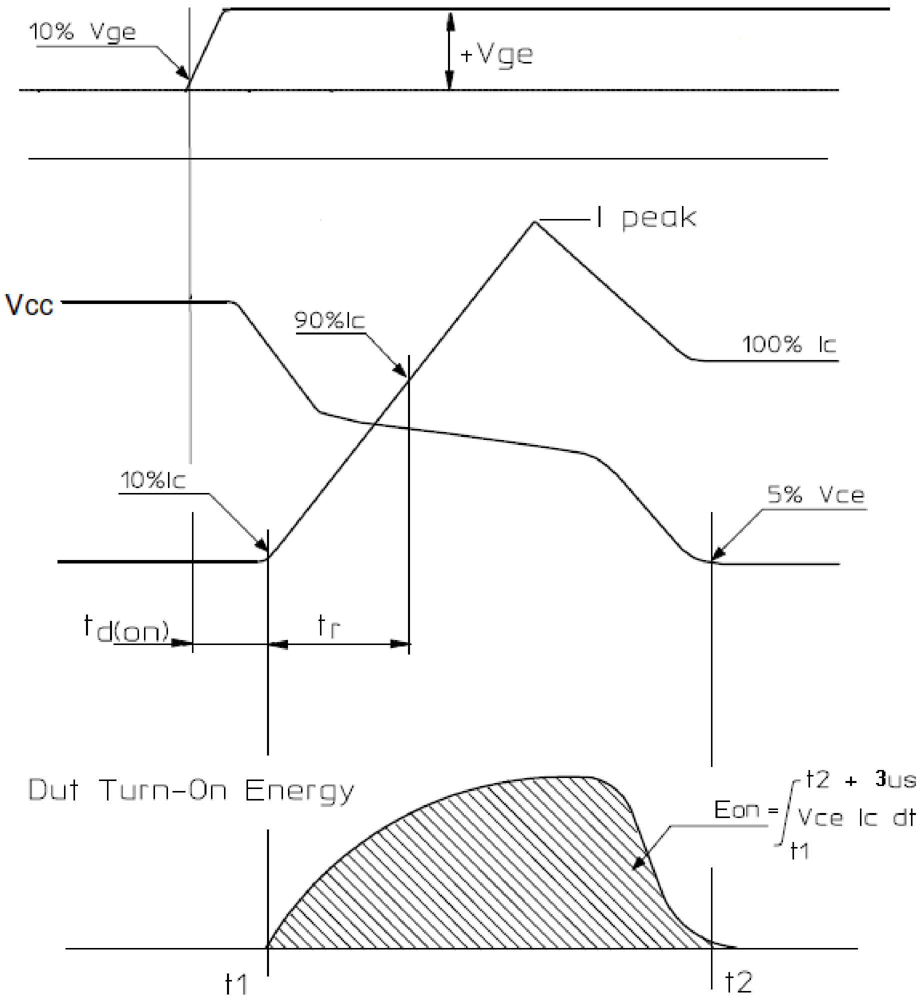


Figure 22. Definition of Turn On Waveform

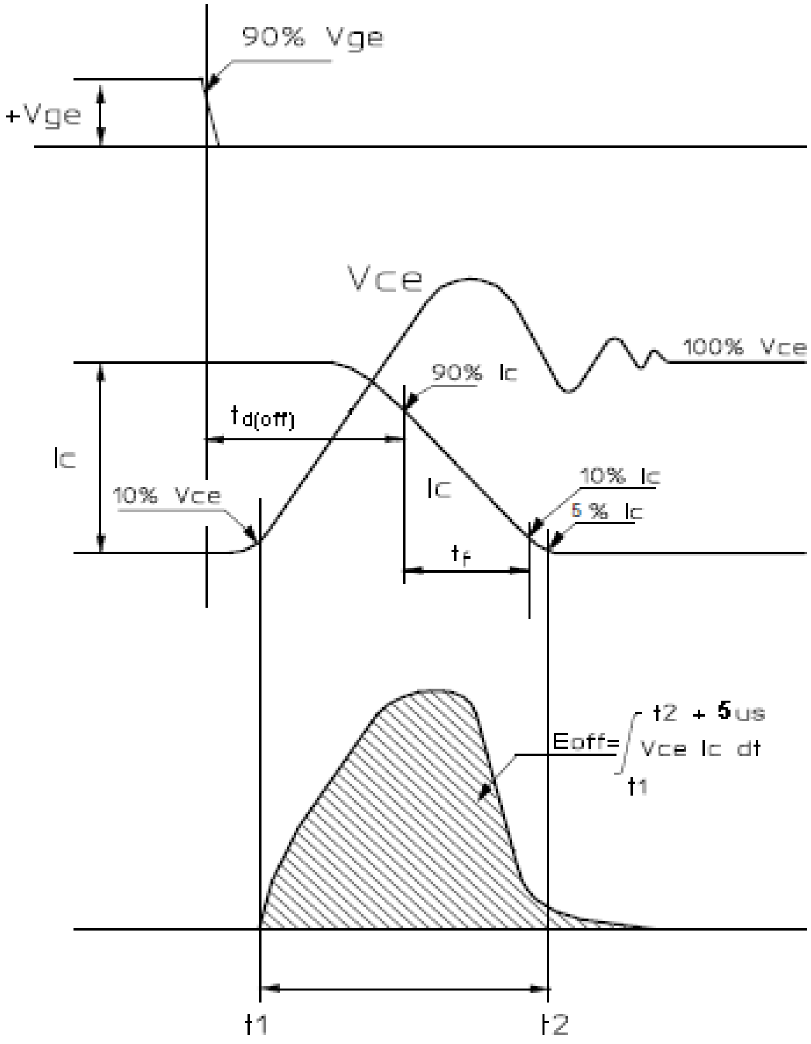
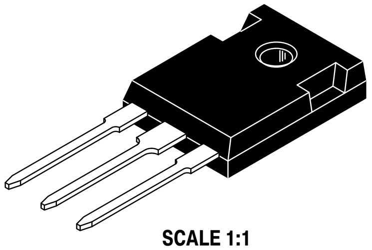


Figure 23. Definition of Turn Off Waveform

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

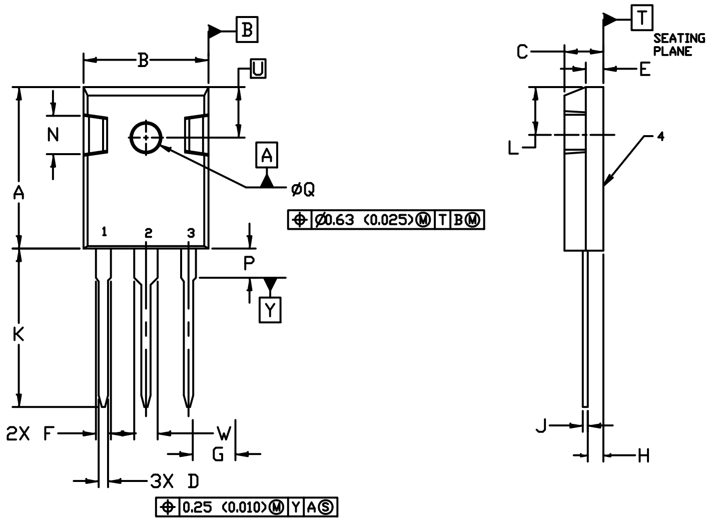
TO−247
CASE 340L
ISSUE G

DATE 06 OCT 2021



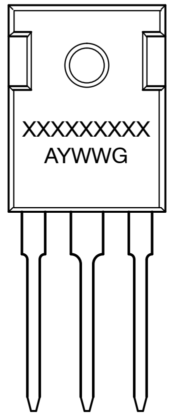
SCALE 1:1

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



DIM	MILLIMETERS MIN.	MILLIMETERS MAX.	INCHES MIN.	INCHES 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*



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.

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

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