NGTB60N60SWG

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 half bridge resonant applications. Incorporated into the device is a soft and fast co−packaged free wheeling diode with a low forward voltage.

Features

- Low Saturation Voltage using Trench with Fieldstop Technology
- Low Switching Loss Reduces System Power Dissipation
- Low Gate Charge
- Soft, Fast Free Wheeling Diode
- These are Pb−Free Devices

Typical Applications

- Inverter Welding

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	 120 60	A
Diode forward current @ T_C = 25°C @ T_C = 100°C	I_F	 120 60	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	240	A
Diode pulsed current, T_{pulse} limited by T_{Jmax}	I_{FM}	240	A
Gate−emitter voltage	V_{GE}	±20	V
Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 298 119	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 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.

ON Semiconductor®

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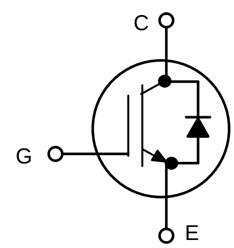
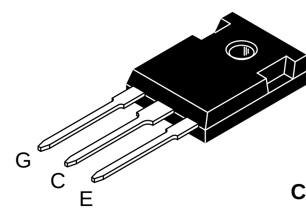
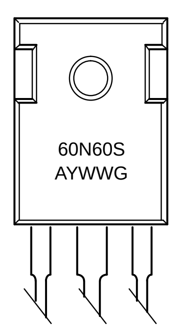
60 A, 600 V
V_{CEsat} = 2.0 V
E_{off} = 0.60 mJ





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
NGTB60N60SWG	TO−247 (Pb−Free)	30 Units / Rail

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.42	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	1.00	°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 = 60 A V_{GE} = 15 V, I_C = 60 A, T_J = 150°C	V_{CEsat}	− −	2.0 2.6	2.5 −	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 150 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}	−	−	200	nA
DYNAMIC CHARACTERISTIC						
Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	−	4112	−	pF
Output capacitance		C_{oes}	−	169	−	
Reverse transfer capacitance		C_{res}	−	107	−	
Gate charge total	V_{CE} = 480 V, I_C = 60 A, V_{GE} = 15 V	Q_g		173		nC
Gate to emitter charge		Q_{ge}		38		
Gate to collector charge		Q_{gc}		87		
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 400 V, I_C = 60 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$		87		ns
Rise time		t_r		48		
Turn−off delay time		$t_{d(off)}$		180		
Fall time		t_f		70		
Turn−off switching loss		E_{off}		0.60		mJ
Turn−on switching loss		E_{on}		1.41		
Turn−on delay time	T_J = 150°C V_{CC} = 400 V, I_C = 60 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$		85		ns
Rise time		t_r		50		
Turn−off delay time		$t_{d(off)}$		186		
Fall time		t_f		91		
Turn−off switching loss		E_{off}		1.11		mJ
Turn−on switching loss		E_{on}		1.77		
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		1.98 2.10	2.30	V
Reverse recovery time	T_J = 25°C I_F = 30 A, V_R = 200 V di_F/dt = 200 A/μs	t_{rr}		76		ns
Reverse recovery charge		Q_{rr}		291		nc
Reverse recovery current		I_{rrm}		7		A

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

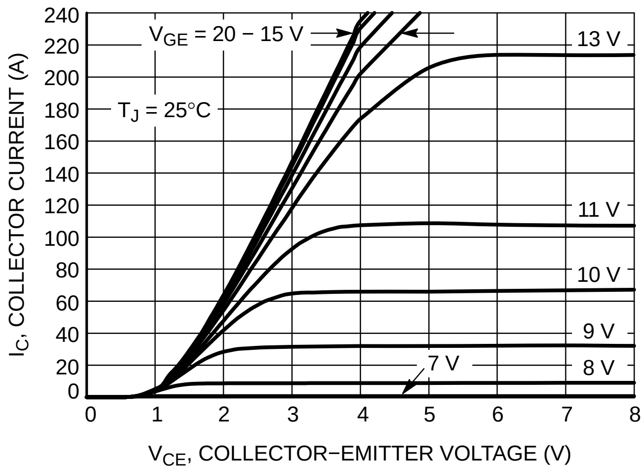


Figure 1. Output Characteristics

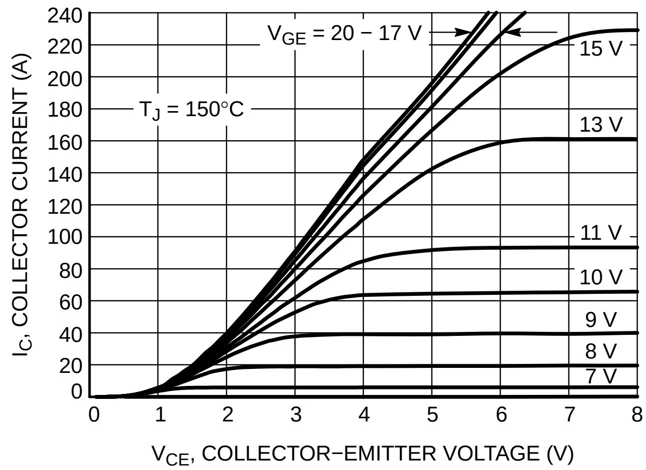


Figure 2. Output Characteristics

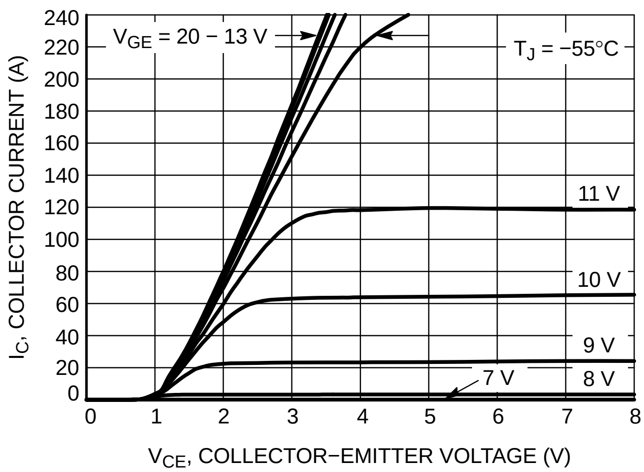


Figure 3. Output Characteristics

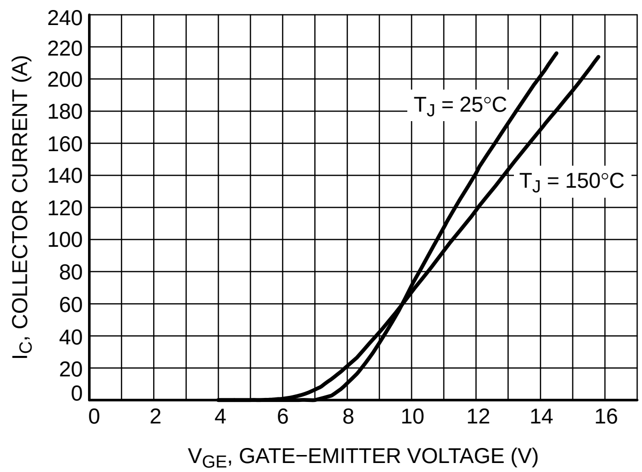


Figure 4. Typical Transfer Characteristics

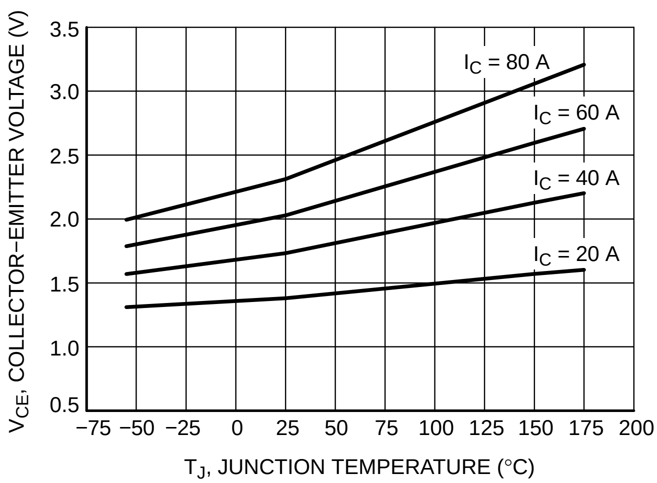


Figure 5. $V_{CE(sat)}$ vs. T_J

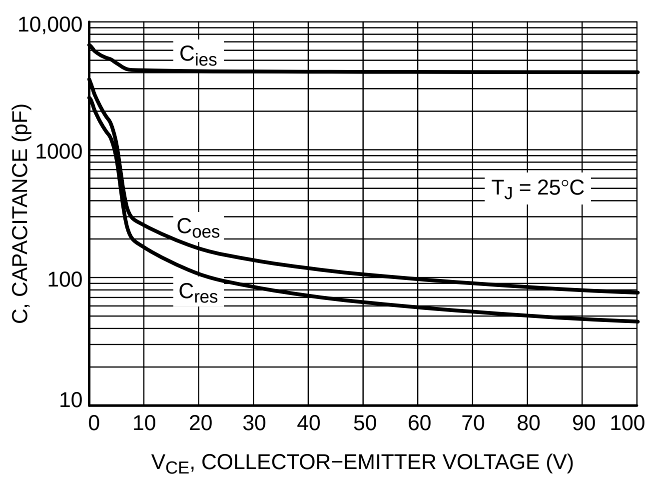


Figure 6. Typical Capacitance

TYPICAL CHARACTERISTICS

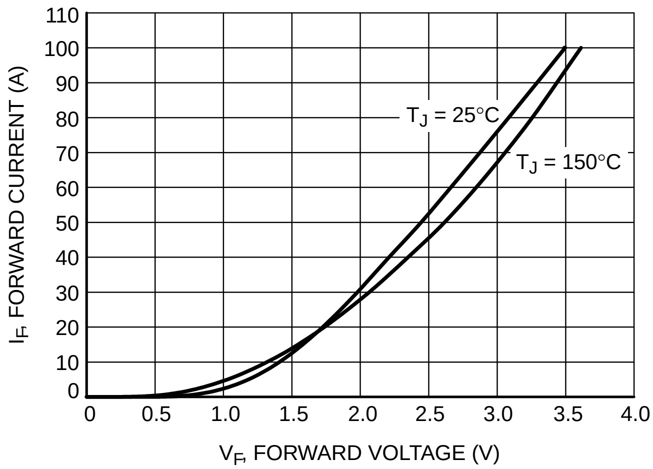


Figure 7. Diode Forward Characteristics

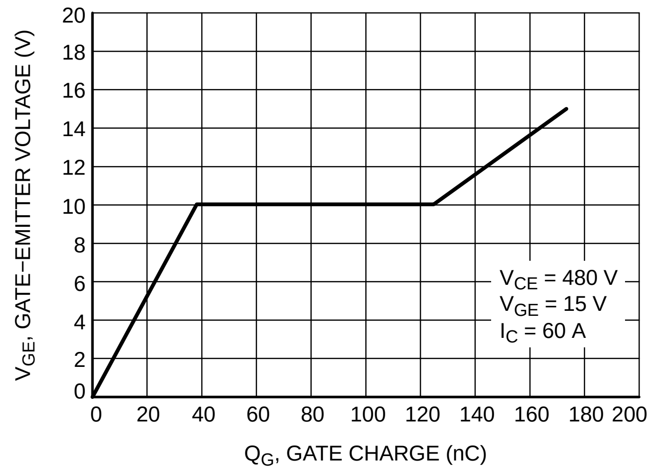


Figure 8. Typical Gate Charge

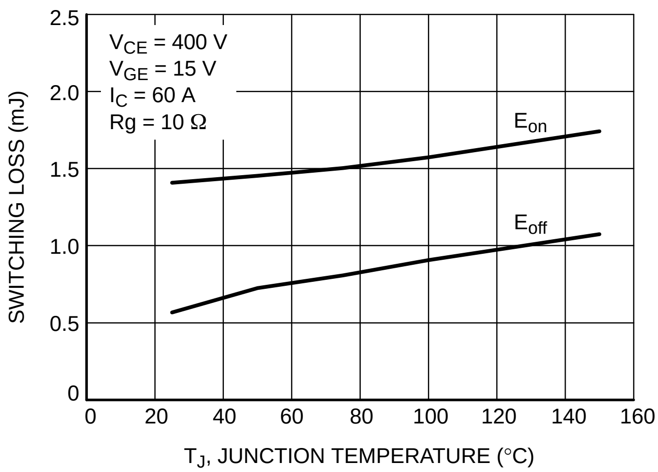


Figure 9. Switching Loss vs. Temperature

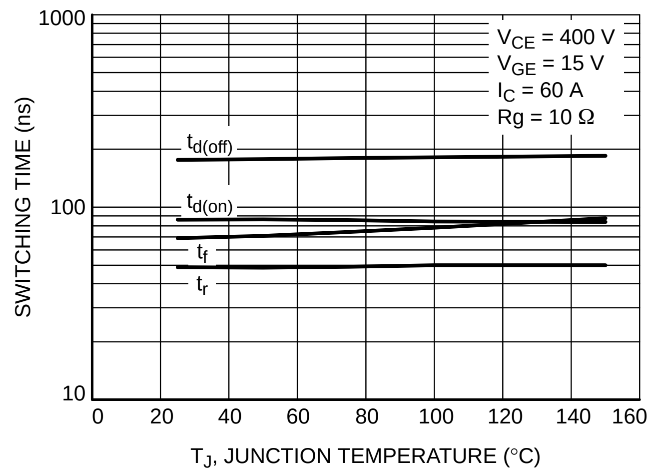


Figure 10. Switching Time vs. Temperature

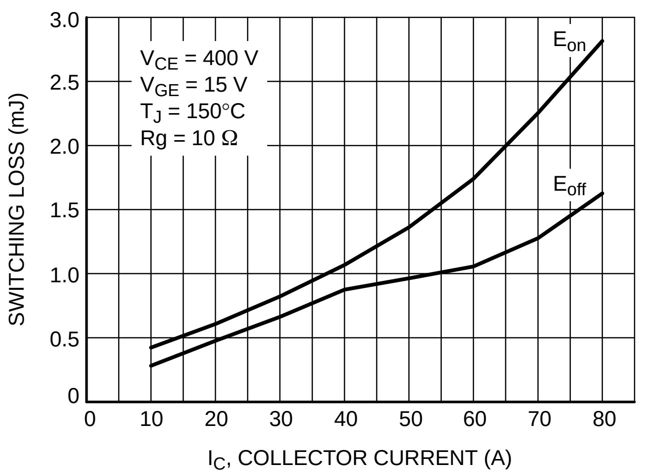


Figure 11. Switching Loss vs. I_C

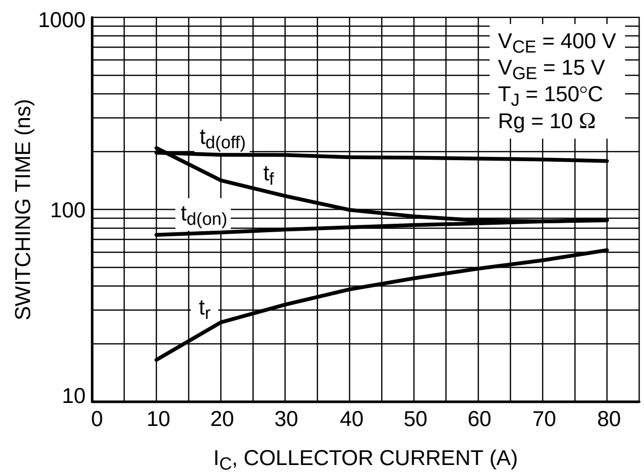


Figure 12. Switching Time vs. I_C

TYPICAL CHARACTERISTICS

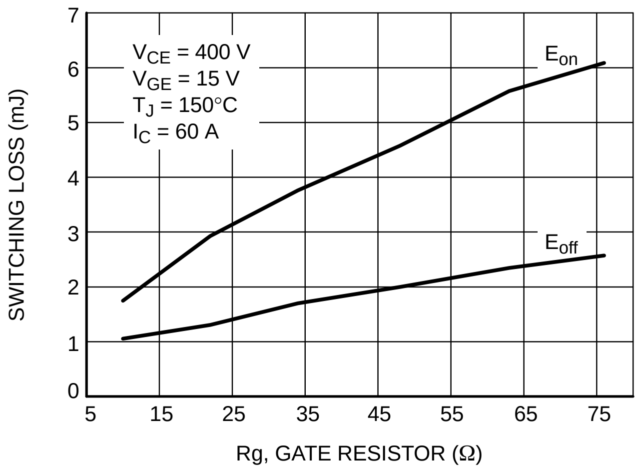


Figure 13. Switching Loss vs. Rg

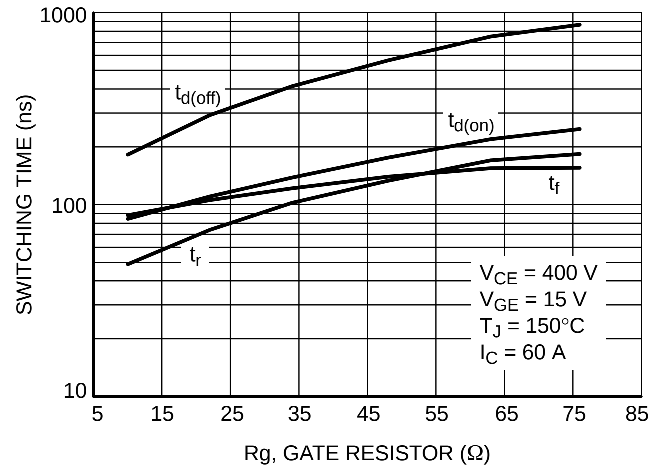


Figure 14. Switching Time vs. Rg

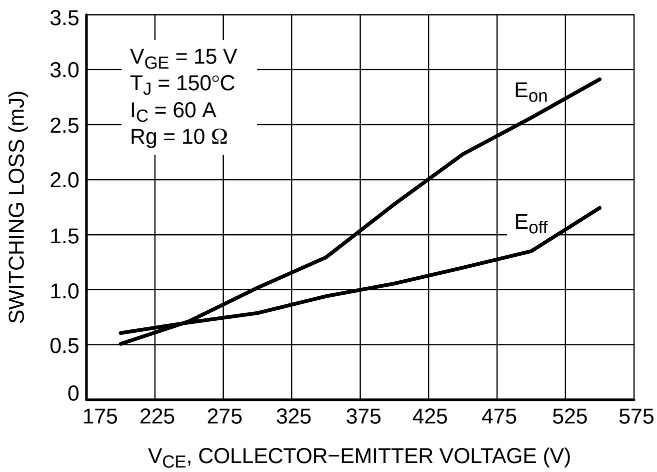


Figure 15. Switching Loss vs. V_{CE}

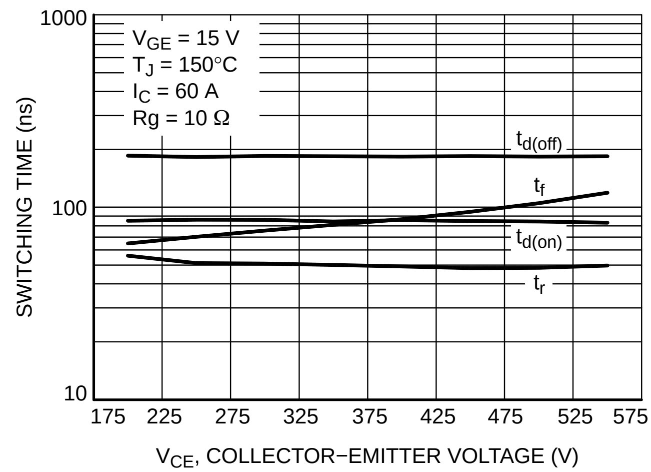


Figure 16. Switching Time vs. V_{CE}

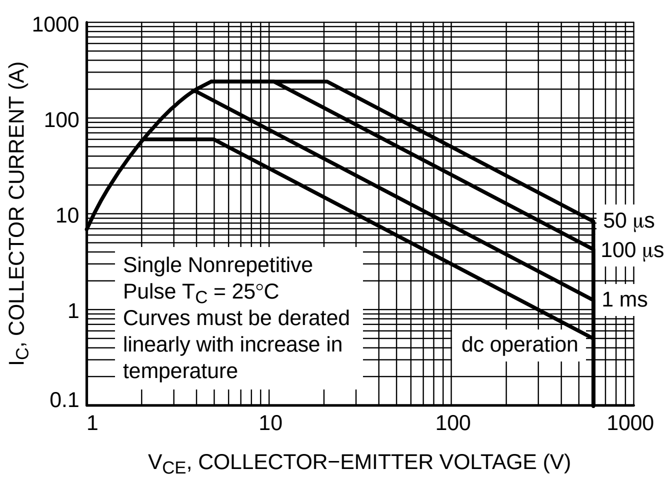


Figure 17. I_C vs. V_{CE}

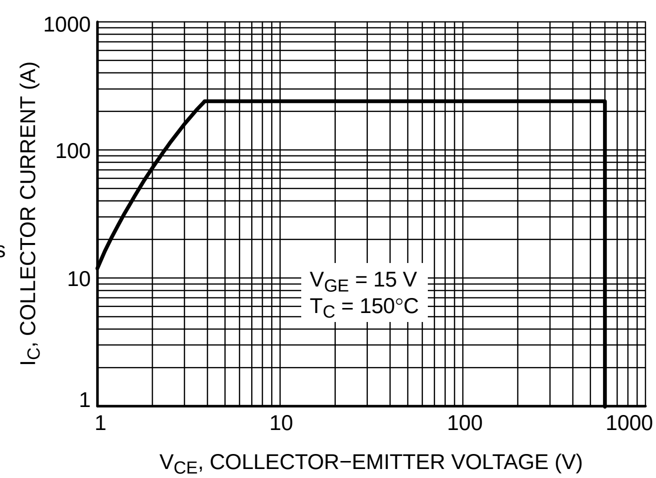


Figure 18. I_C vs. V_{CE}

TYPICAL CHARACTERISTICS

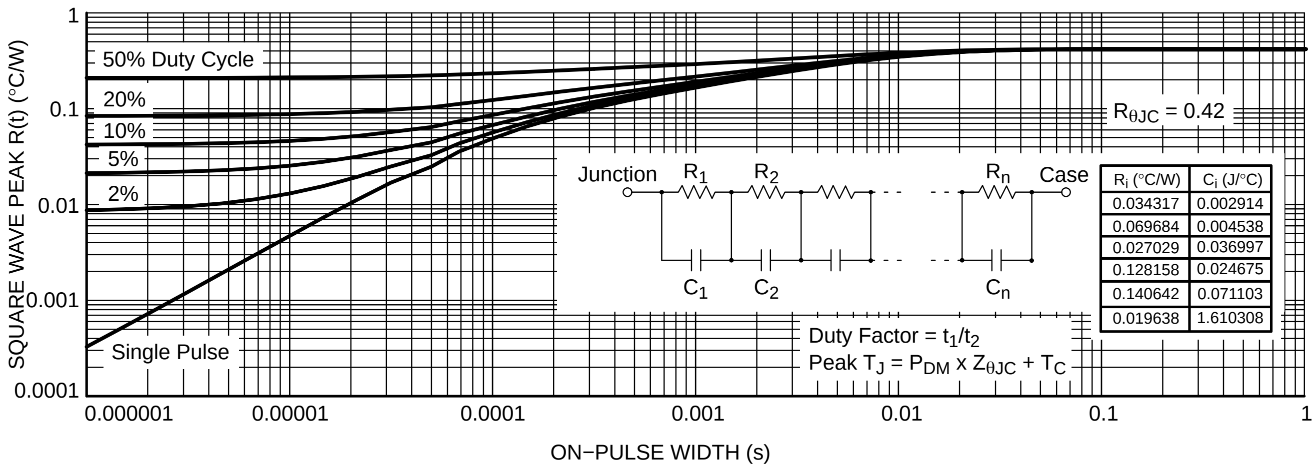


Figure 19. IGBT Transient Thermal Impedance

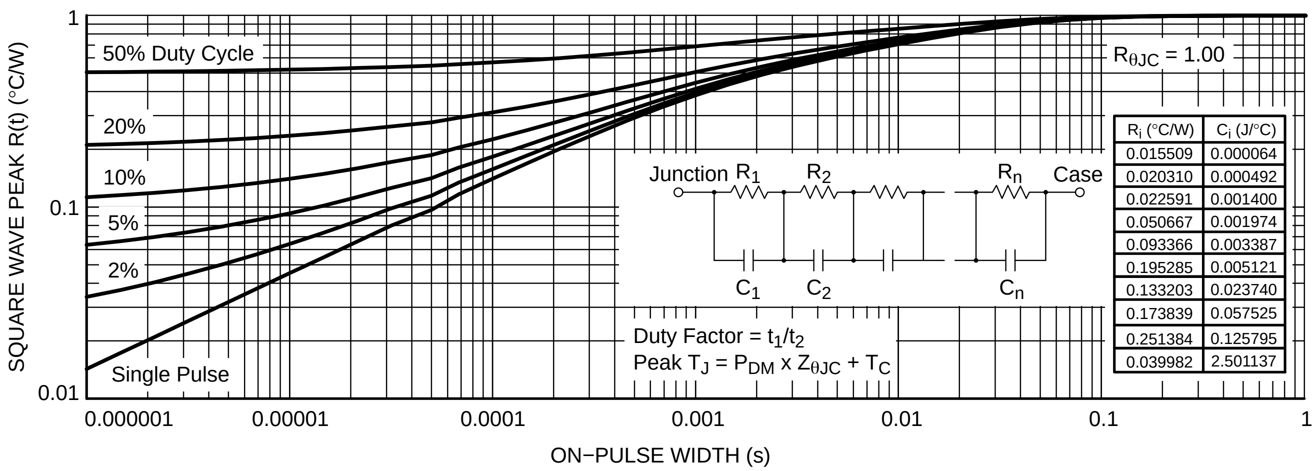
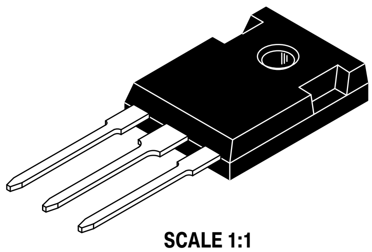


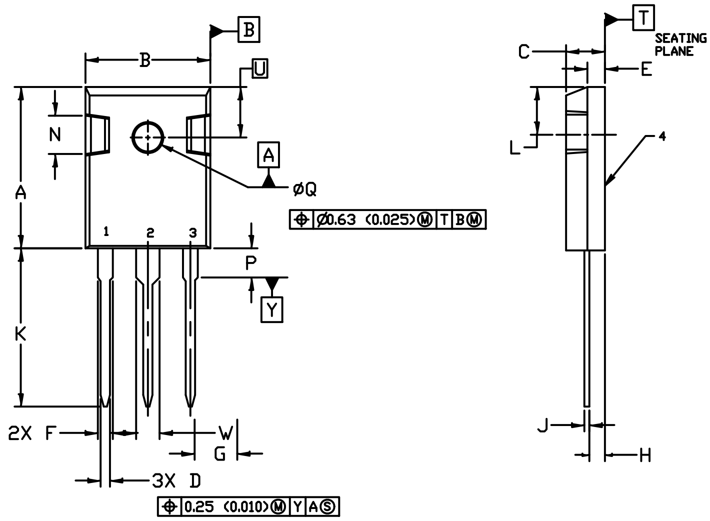
Figure 20. Diode Transient Thermal Impedance



SCALE 1:1

TO−247
CASE 340L
ISSUE G

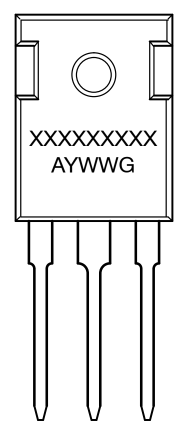
DATE 06 OCT 2021



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*



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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DESCRIPTION:	**TO−247**	**PAGE 1 OF 1**

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