

NGTB50N60FWG

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 μ s Short-Circuit Capability
- These are Pb-Free Devices

Typical Applications

- Solar Inverters
- Uninterruptible Power Supplies (UPS)
- Motor Drives

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	600	V
Collector current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	I_C	100 50	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	200	A
Diode Forward Current @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	I_F	100 50	A
Diode Pulsed Current T_{pulse} limited by T_{Jmax}	I_{FM}	200	A
Short-circuit withstand time $V_{GE} = 15\text{ V}$, $V_{CE} = 300\text{ V}$, $T_J \leq +150^\circ\text{C}$	t_{SC}	5	μ s
Gate-emitter voltage Transient Gate-Emitter Voltage	V_{GE}	± 20 ± 30	V
Power Dissipation @ $T_c = 25^\circ\text{C}$ @ $T_c = 100^\circ\text{C}$	P_D	223 89	W
Operating junction temperature range	T_J	-55 to $+150$	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55 to $+150$	$^\circ\text{C}$
Lead temperature for soldering, 1/8" from case for 5 seconds	T_{SLD}	260	$^\circ\text{C}$

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.



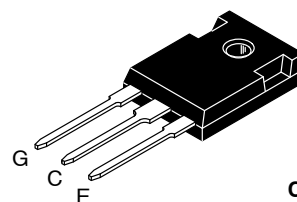
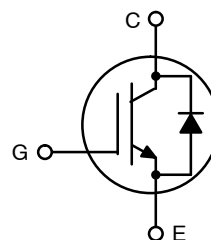
ON Semiconductor®

<http://onsemi.com>

50 A, 600 V

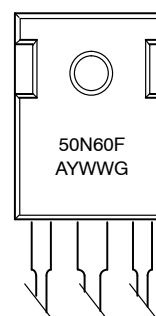
$V_{CEsat} = 1.45\text{ V}$

$E_{OFF} = 1.20\text{ mJ}$



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
NGTB50N60FWG	TO-247 (Pb-Free)	30 Units / Rail

NGTB50N60FWG

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.56	$^{\circ}\text{C/W}$
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	0.74	$^{\circ}\text{C/W}$
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^{\circ}\text{C/W}$

ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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STATIC CHARACTERISTIC

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, I_C = 500\text{ }\mu\text{A}$	$V_{(BR)CES}$	600	–	–	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 150^{\circ}\text{C}$	V_{CEsat}	1.25 –	1.45 1.7	1.7 –	V
Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 350\text{ }\mu\text{A}$	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$ $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150^{\circ}\text{C}$	I_{CES}	– –	– –	0.5 2	mA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20\text{ V}, V_{CE} = 0\text{ V}$	I_{GES}	–	–	200	nA

DYNAMIC CHARACTERISTIC

Input capacitance	$V_{CE} = 20\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{ies}	–	7300	–	pF
Output capacitance		C_{oes}	–	275	–	
Reverse transfer capacitance		C_{res}	–	170	–	
Gate charge total	$V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	Q_g	–	310	–	nC
Gate to emitter charge		Q_{ge}	–	60	–	
Gate to collector charge		Q_{gc}	–	150	–	

SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-on delay time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\text{ }\Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	–	117	–	ns
Rise time		t_r	–	43	–	
Turn-off delay time		$t_{d(off)}$	–	285	–	
Fall time		t_f	–	105	–	
Turn-on switching loss		E_{on}	–	1.1	–	mJ
Turn-off switching loss		E_{off}	–	1.2	–	
Total switching loss		E_{ts}	–	2.3	–	
Turn-on delay time	$T_J = 150^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\text{ }\Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	–	112	–	ns
Rise time		t_r	–	45	–	
Turn-off delay time		$t_{d(off)}$	–	300	–	
Fall time		t_f	–	214	–	
Turn-on switching loss		E_{on}	–	1.4	–	mJ
Turn-off switching loss		E_{off}	–	2.0	–	
Total switching loss		E_{ts}	–	3.4	–	

NGTB50N60FWG

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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DIODE CHARACTERISTIC

Forward voltage	$V_{GE} = 0\text{ V}, I_F = 50\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 50\text{ A}, T_J = 150^\circ\text{C}$	V_F	1.4 –	1.95 2.1	2.5 –	V
Reverse recovery time	$T_J = 25^\circ\text{C}$ $I_F = 50\text{ A}, V_R = 200\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$	t_{rr}	–	77	–	ns
Reverse recovery charge		Q_{rr}	–	0.4	–	μC
Reverse recovery current		I_{rrm}	–	8	–	A

TYPICAL CHARACTERISTICS

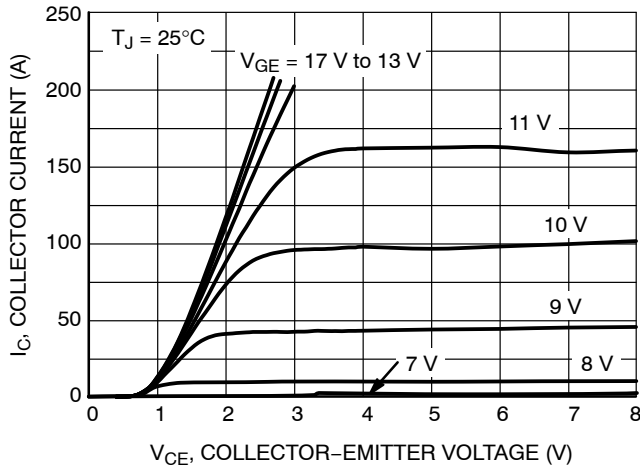


Figure 1. Output Characteristics

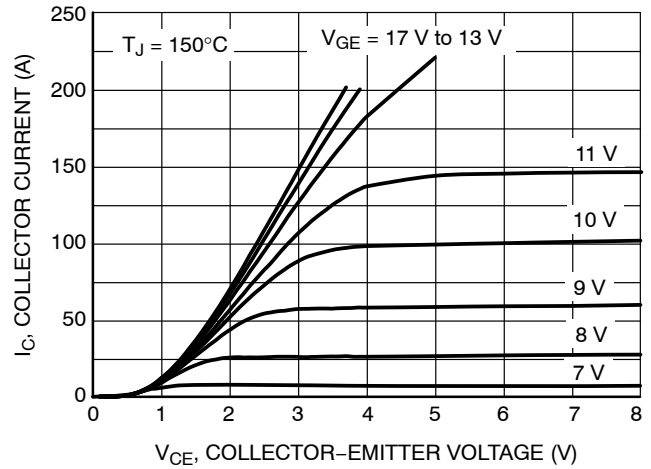


Figure 2. Output Characteristics

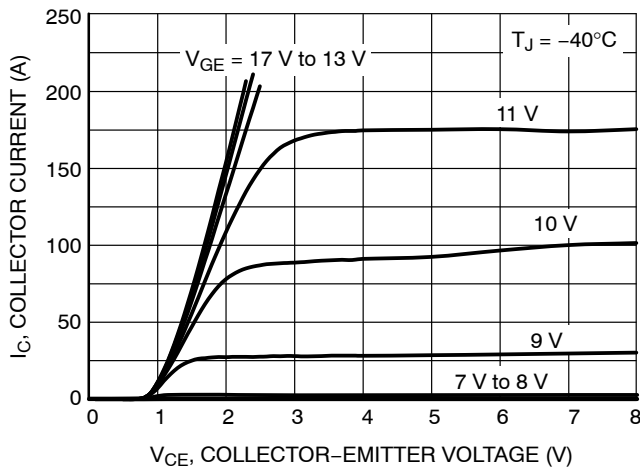


Figure 3. Output Characteristics

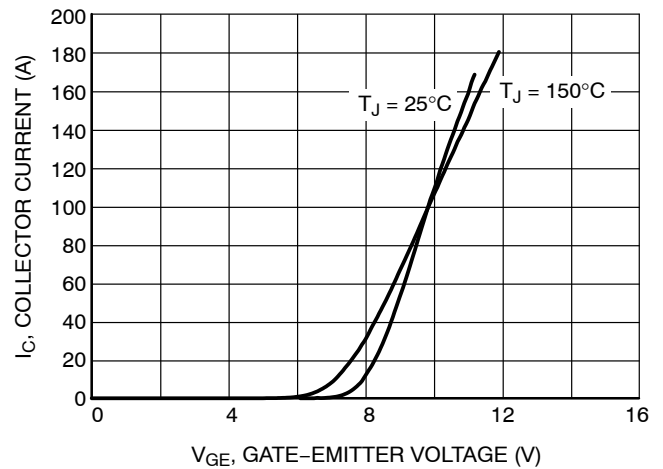


Figure 4. Typical Transfer Characteristics

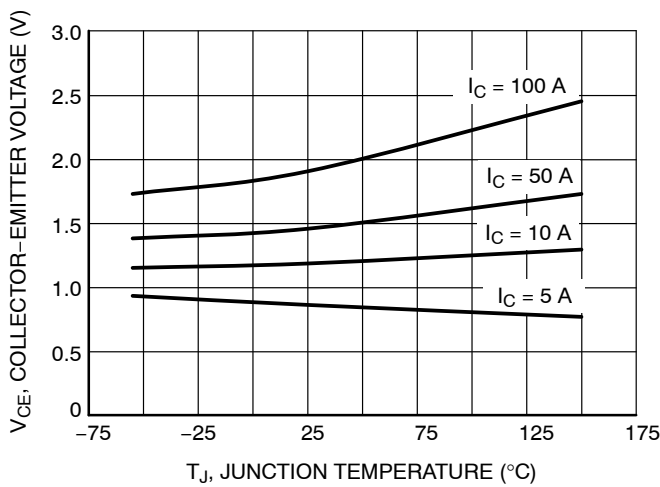


Figure 5. $V_{CE(sat)}$ vs. T_J

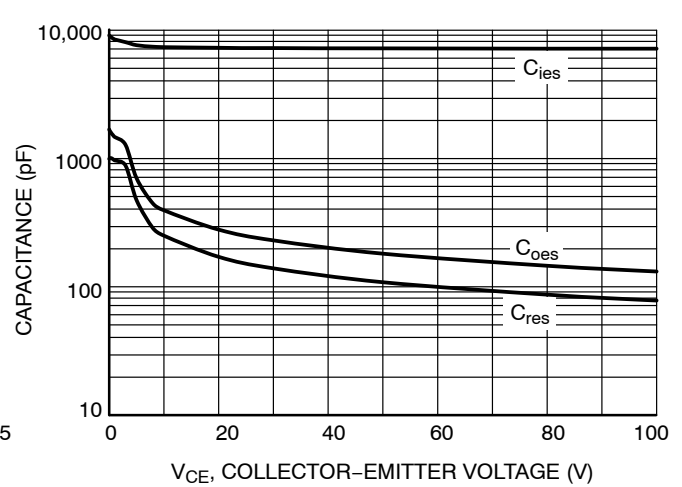


Figure 6. Typical Capacitance

TYPICAL CHARACTERISTICS

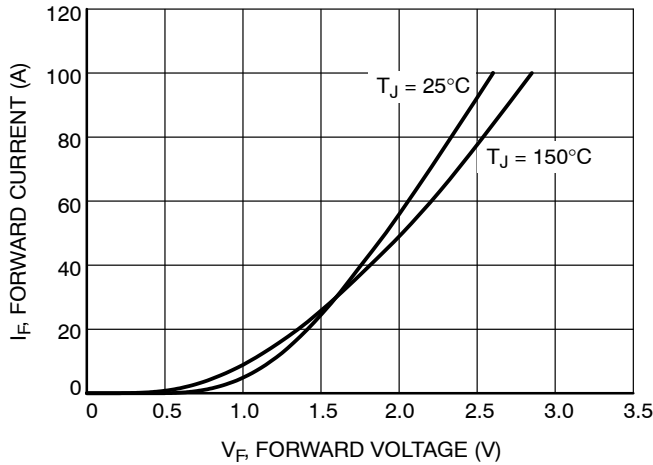


Figure 7. Diode Forward Characteristics

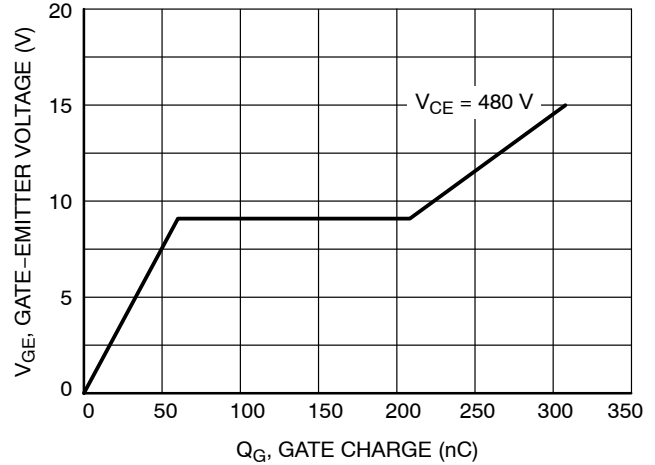


Figure 8. Typical Gate Charge

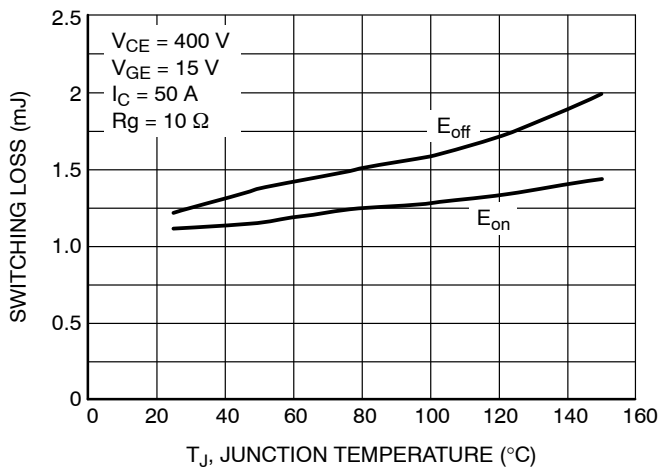


Figure 9. Switching Loss vs. Temperature

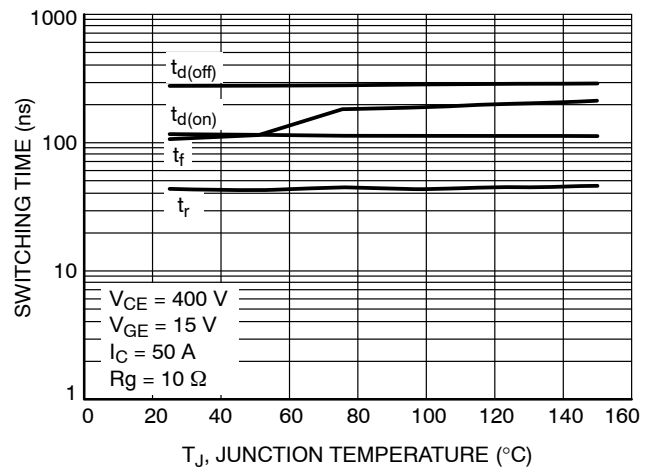


Figure 10. Switching Time vs. Temperature

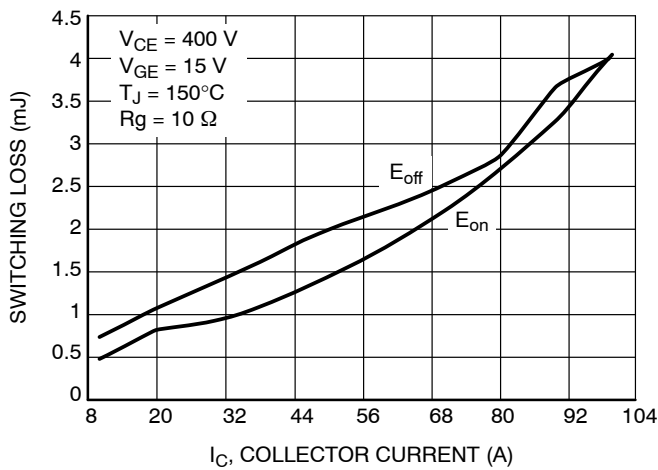


Figure 11. Switching Loss vs. I_C

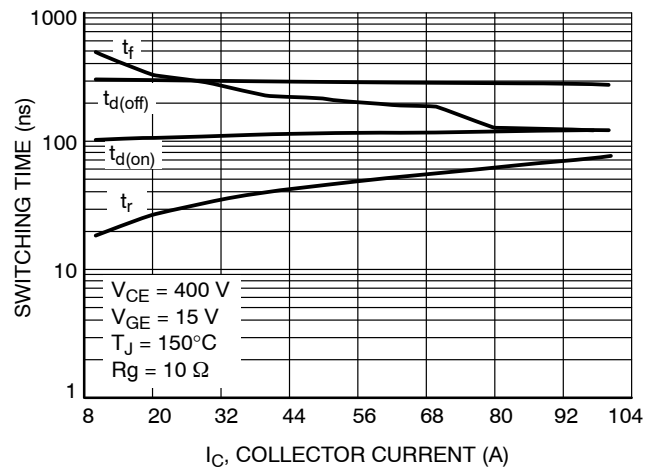


Figure 12. Switching Time vs. I_C

TYPICAL CHARACTERISTICS

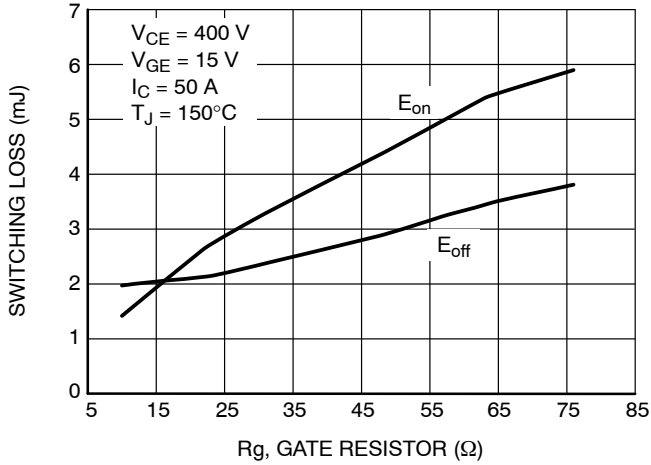


Figure 13. Switching Loss vs. Rg

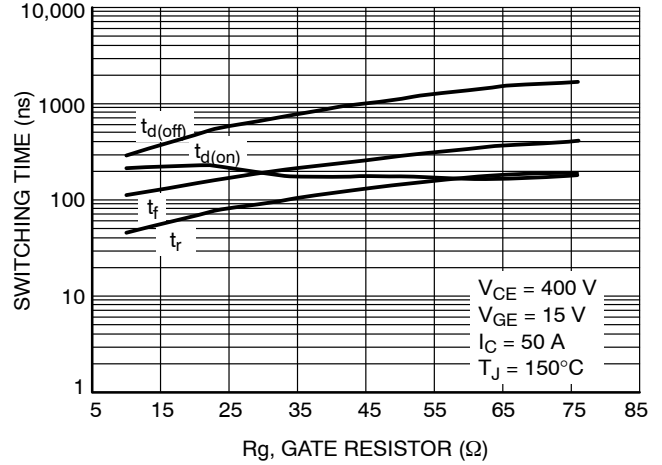


Figure 14. Switching Time vs. Rg

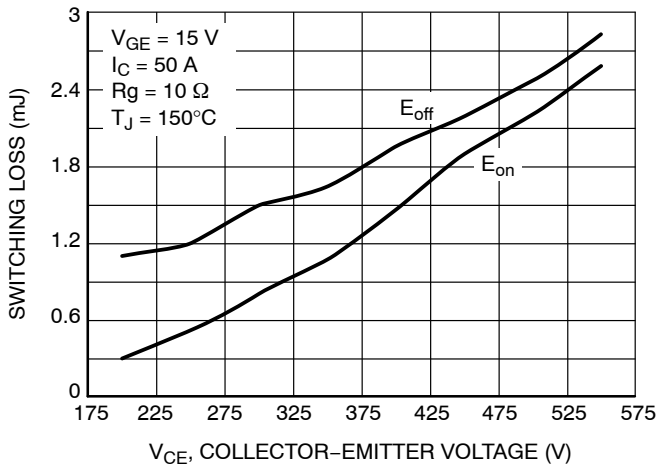


Figure 15. Switching Loss vs. V_{CE}

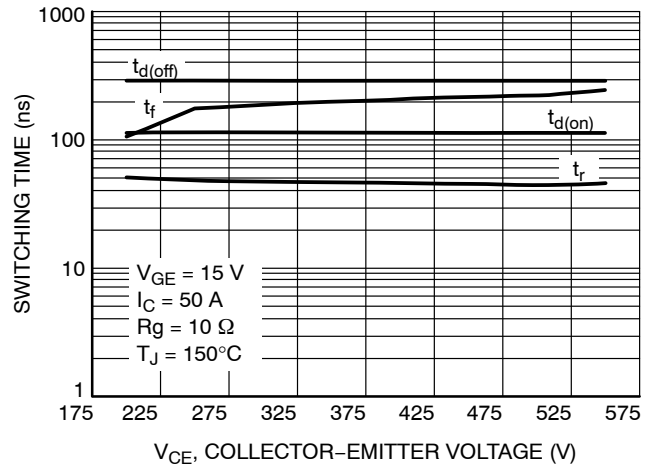


Figure 16. Switching Time vs. V_{CE}

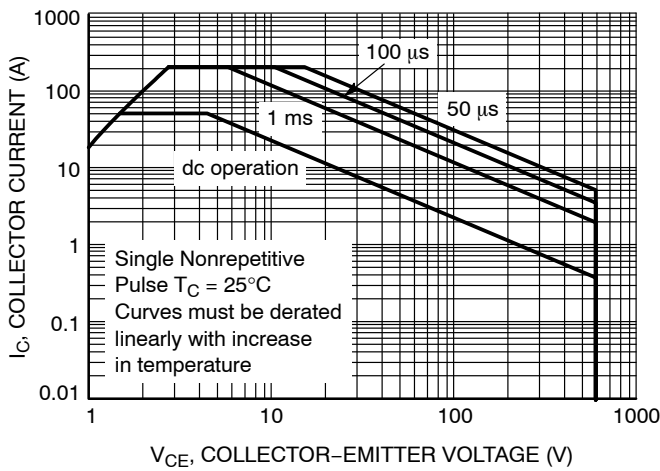


Figure 17. Safe Operating Area

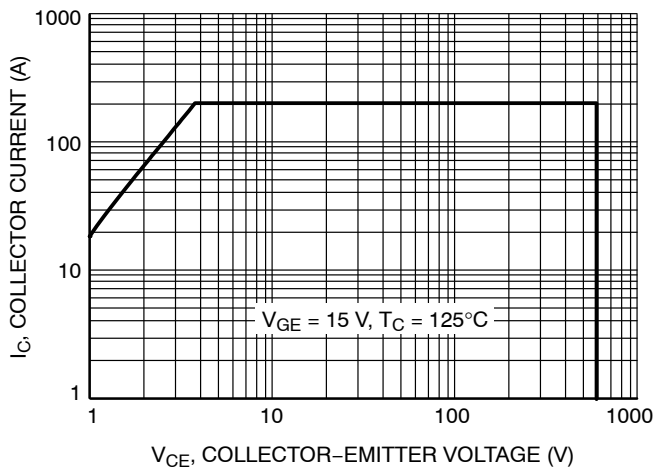


Figure 18. Reverse Bias Safe Operating Area

NGTB50N60FWG

TYPICAL CHARACTERISTICS

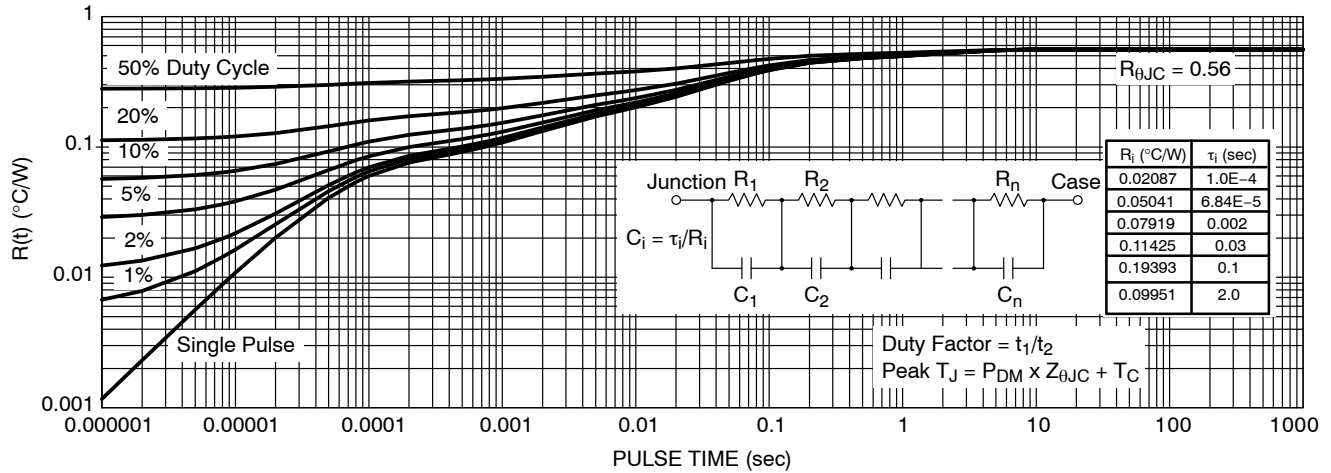


Figure 19. IGBT Transient Thermal Impedance

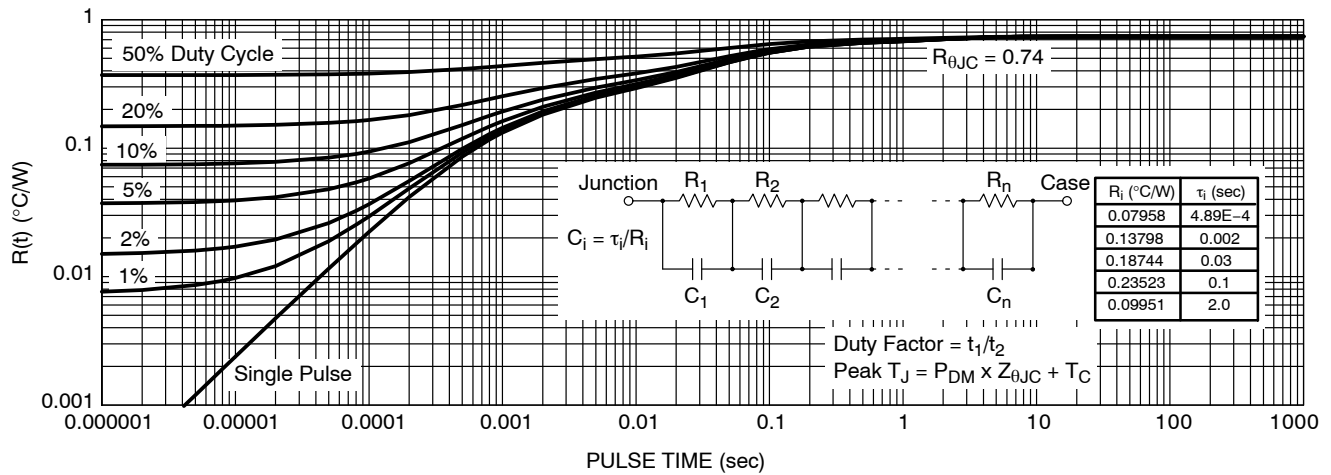


Figure 20. Diode Transient Thermal Impedance

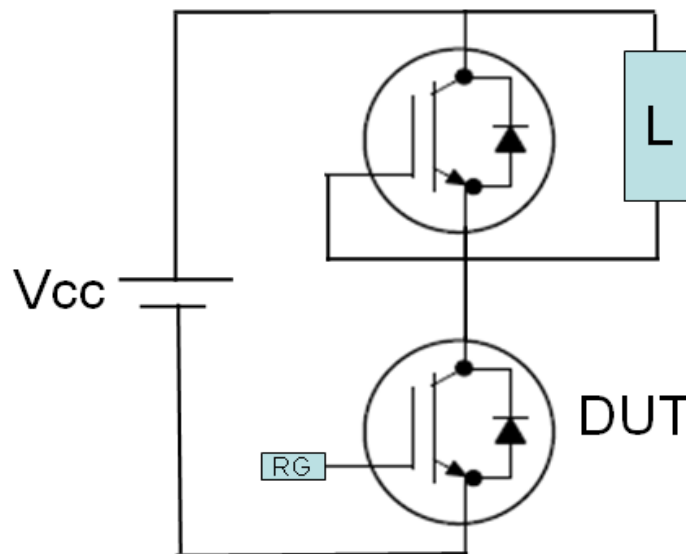


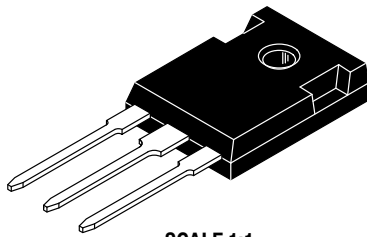
Figure 21. Test Circuit for Switching Characteristics



Figure 22. Definition of Turn On Waveform



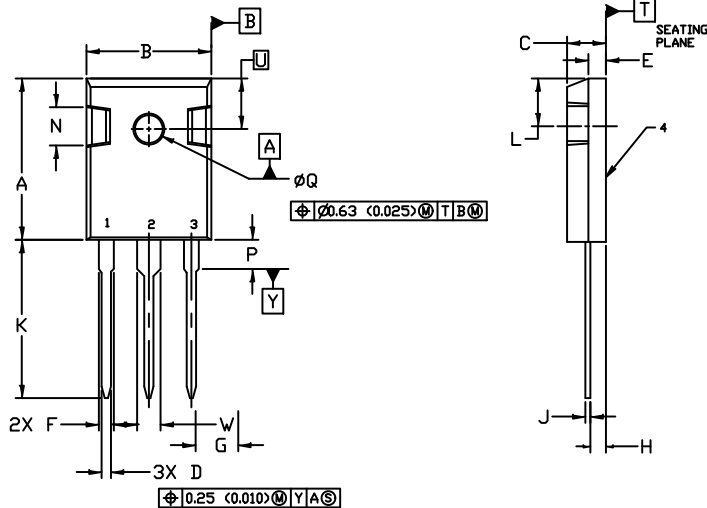
Figure 23. Definition of Turn Off Waveform



TO-247
CASE 340L
ISSUE G

DATE 06 OCT 2021

SCALE 1:1

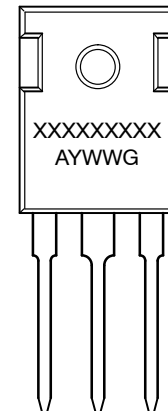


NOTES:

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. CATHODE (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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