

NGTB50N60FL2WG

IGBT - Field Stop II

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Field Stop II 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 UPS and solar applications. Incorporated into the device is a soft and fast co-packaged free wheeling diode with a low forward voltage.

Features

- Extremely Efficient Trench with Field Stop Technology
- $T_{Jmax} = 175^{\circ}C$
- Soft Fast Reverse Recovery Diode
- Optimized for High Speed Switching
- 5 μs Short-Circuit Capability
- This is a Pb-Free Device

Typical Applications

- Solar Inverters
- Uninterruptible Power Supplies (UPS)
- Welding

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	600	V
Collector current @ $T_c = 25^{\circ}C$ @ $T_c = 100^{\circ}C$	I_c	100 50	A
Diode Forward Current @ $T_c = 25^{\circ}C$ @ $T_c = 100^{\circ}C$	I_F	100 50	A
Diode Pulsed Current T_{PULSE} Limited by T_J Max	I_{FM}	200	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	200	A
Short-circuit withstand time $V_{GE} = 15$ V, $V_{CE} = 400$ V, $T_J \leq +150^{\circ}C$	t_{SC}	5	μs
Gate-emitter voltage	V_{GE}	± 20	V
Transient gate-emitter voltage ($T_{PULSE} = 5 \mu s$, $D < 0.10$)		± 30	V
Power Dissipation @ $T_c = 25^{\circ}C$ @ $T_c = 100^{\circ}C$	P_D	417 208	W
Operating junction temperature range	T_J	-55 to $+175$	$^{\circ}C$
Storage temperature range	T_{stg}	-55 to $+175$	$^{\circ}C$
Lead temperature for soldering, 1/8" from case for 5 seconds	T_{SLD}	260	$^{\circ}C$

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.



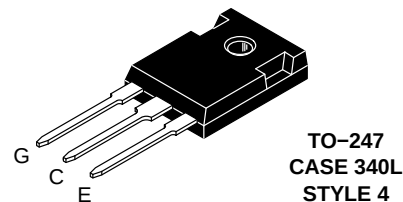
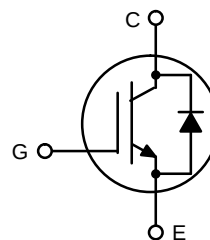
ON Semiconductor®

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50 A, 600 V

$V_{CEsat} = 1.80$ V

$E_{OFF} = 0.46$ mJ



MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping
NGTB50N60FL2WG	TO-247 (Pb-Free)	30 Units / Rail

NGTB50N60FL2WG

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.36	$^{\circ}\text{C/W}$
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	0.60	$^{\circ}\text{C/W}$
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	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 175^{\circ}\text{C}$	V_{CEsat}	1.50 —	1.80 2.19	2.00 —	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 4.0	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}	—	5328	—	pF
Output capacitance		C_{oes}	—	252	—	
Reverse transfer capacitance		C_{res}	—	148	—	
Gate charge total	$V_{CE} = 480\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	Q_g	—	220	—	nC
Gate to emitter charge		Q_{ge}	—	52	—	
Gate to collector charge		Q_{gc}	—	116	—	

SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-on delay time	$T_J = 25^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\text{ }\Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	—	100	—	ns
Rise time		t_r	—	47	—	
Turn-off delay time		$t_{d(off)}$	—	237	—	
Fall time		t_f	—	67	—	
Turn-on switching loss		E_{on}	—	1.50	—	mJ
Turn-off switching loss		E_{off}	—	0.46	—	
Total switching loss		E_{ts}	—	1.96	—	
Turn-on delay time	$T_J = 150^{\circ}\text{C}$ $V_{CC} = 400\text{ V}, I_C = 50\text{ A}$ $R_g = 10\text{ }\Omega$ $V_{GE} = 0\text{ V}/15\text{ V}$	$t_{d(on)}$	—	90	—	ns
Rise time		t_r	—	49	—	
Turn-off delay time		$t_{d(off)}$	—	245	—	
Fall time		t_f	—	96	—	
Turn-on switching loss		E_{on}	—	1.90	—	mJ
Turn-off switching loss		E_{off}	—	0.83	—	
Total switching loss		E_{ts}	—	2.73	—	

DIODE CHARACTERISTIC

Forward voltage	$V_{GE} = 0\text{ V}, I_F = 50\text{ A}$ $V_{GE} = 0\text{ V}, I_F = 50\text{ A}, T_J = 175^{\circ}\text{C}$	V_F	— —	2.10 2.20	2.90 —	V
Reverse recovery time	$T_J = 25^{\circ}\text{C}$ $I_F = 50\text{ A}, V_R = 400\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$	t_{rr}	—	94	—	ns
Reverse recovery charge		Q_{rr}	—	0.45	—	μC
Reverse recovery current		I_{rrm}	—	8	—	A
Reverse recovery time	$T_J = 175^{\circ}\text{C}$ $I_F = 50\text{ A}, V_R = 400\text{ V}$ $di_F/dt = 200\text{ A}/\mu\text{s}$	t_{rr}	—	170	—	ns
Reverse recovery charge		Q_{rr}	—	1.40	—	μC
Reverse recovery current		I_{rrm}	—	13	—	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.

NGTB50N60FL2WG

TYPICAL CHARACTERISTICS

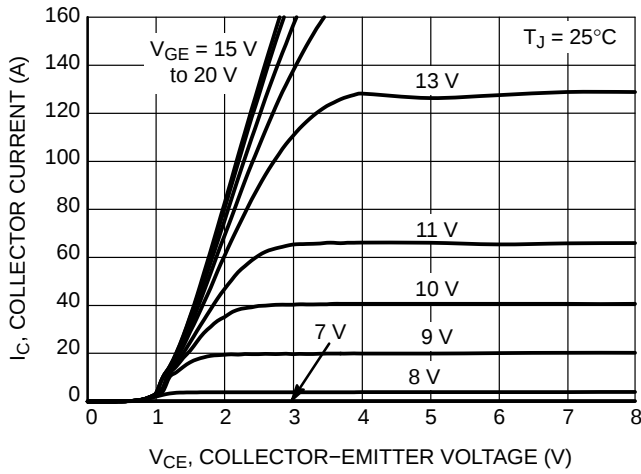


Figure 1. Output Characteristics

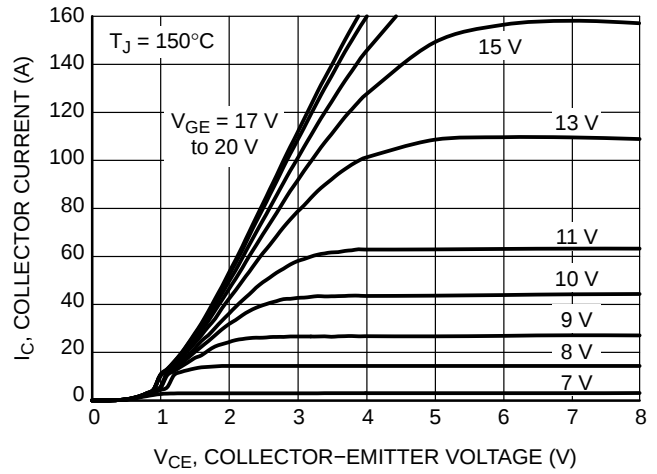


Figure 2. Output Characteristics

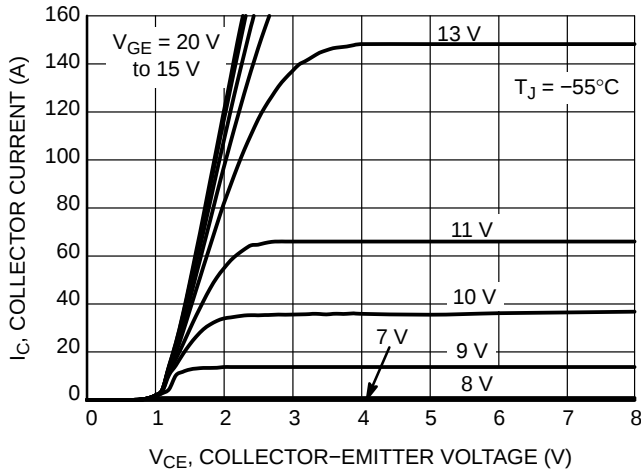


Figure 3. Output Characteristics

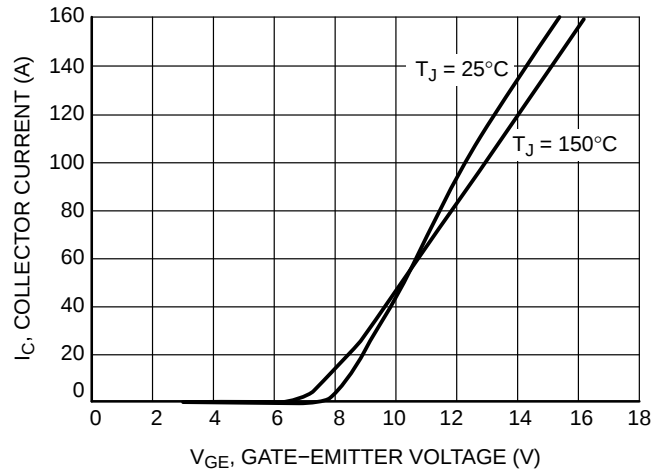


Figure 4. Typical Transfer Characteristics

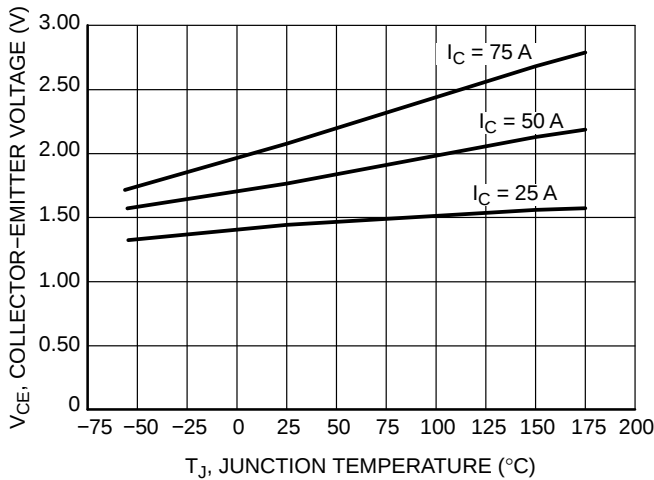


Figure 5. $V_{CE(sat)}$ vs. T_J

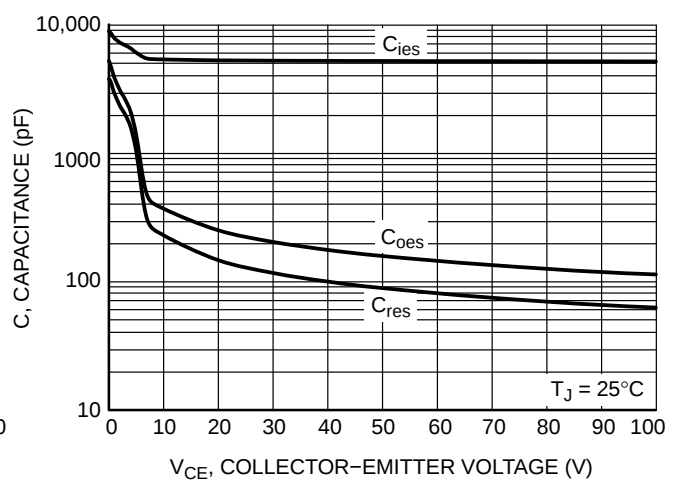


Figure 6. Typical Capacitance

NGTB50N60FL2WG

TYPICAL CHARACTERISTICS

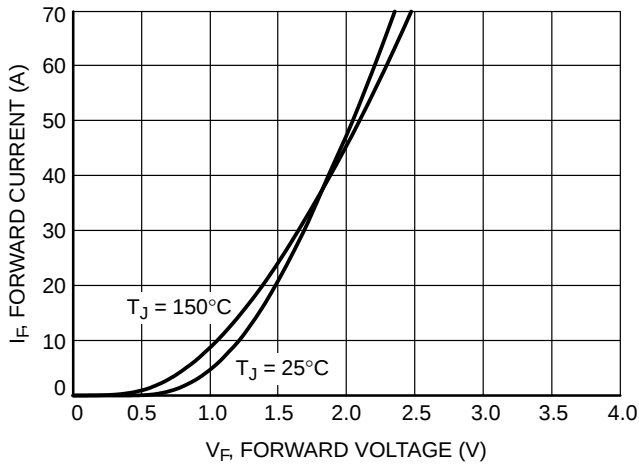


Figure 7. Diode Forward Characteristics

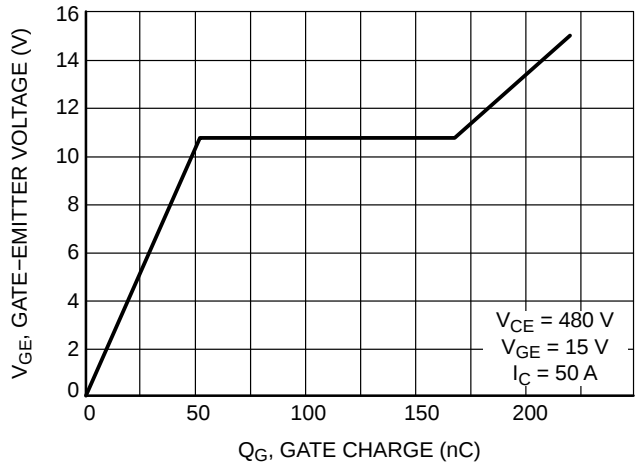


Figure 8. Typical Gate Charge

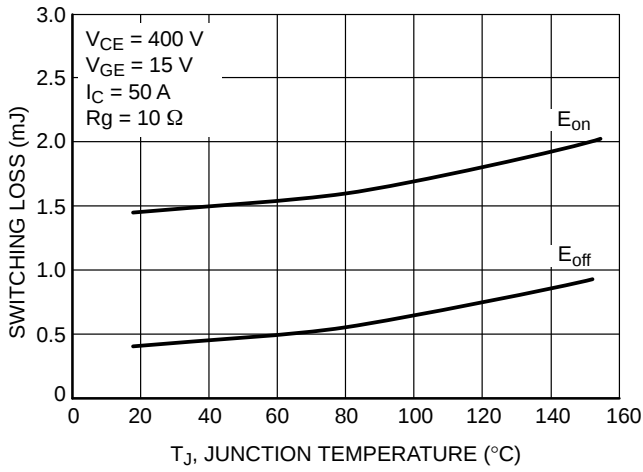


Figure 9. Switching Loss vs. Temperature

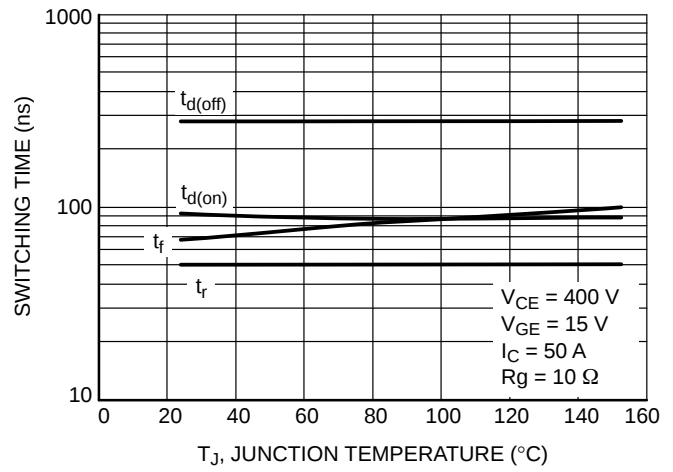


Figure 10. Switching Time vs. Temperature

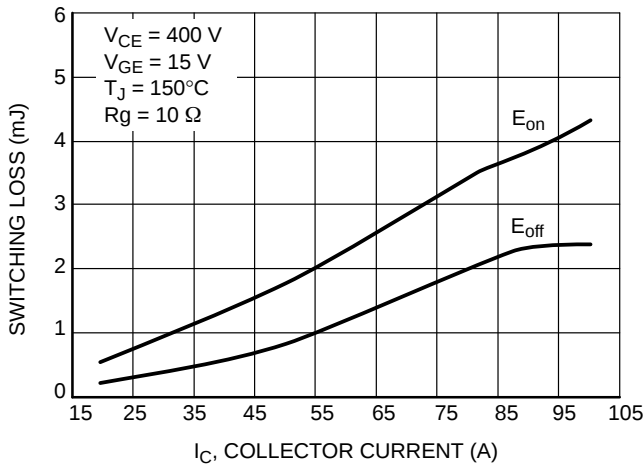


Figure 11. Switching Loss vs. I_C

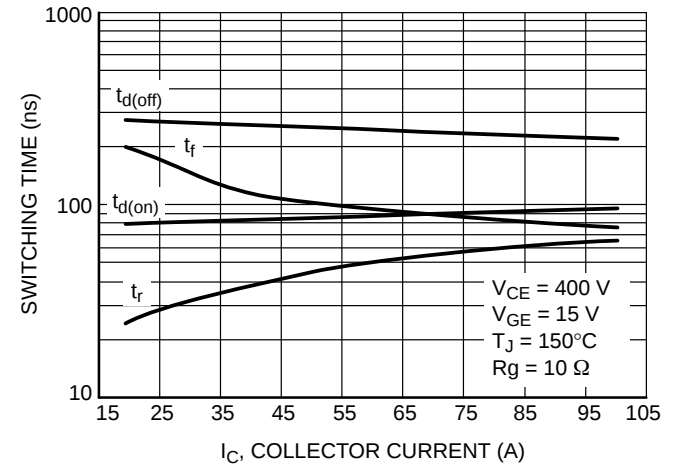
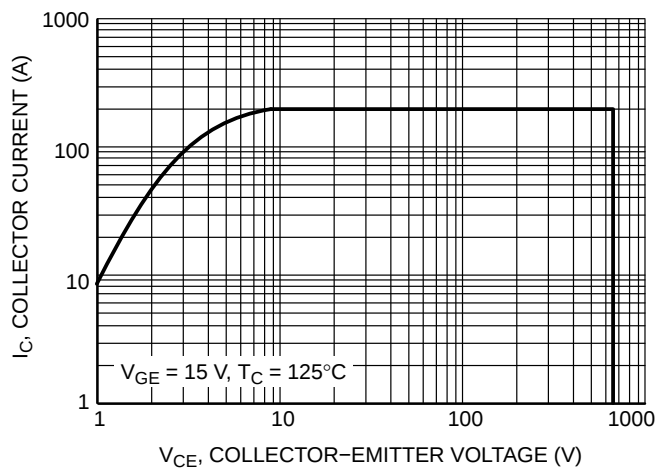
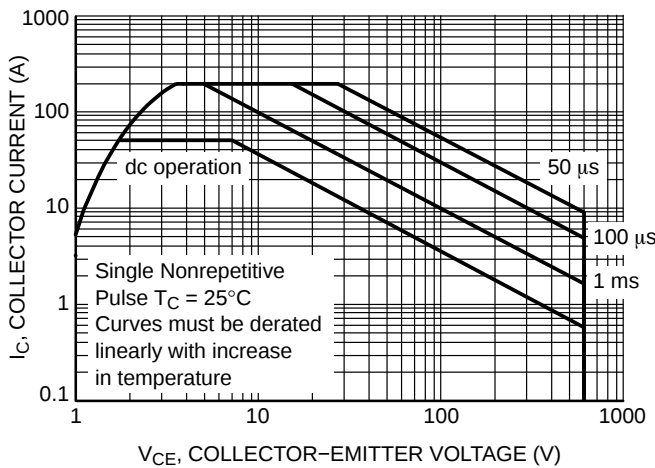
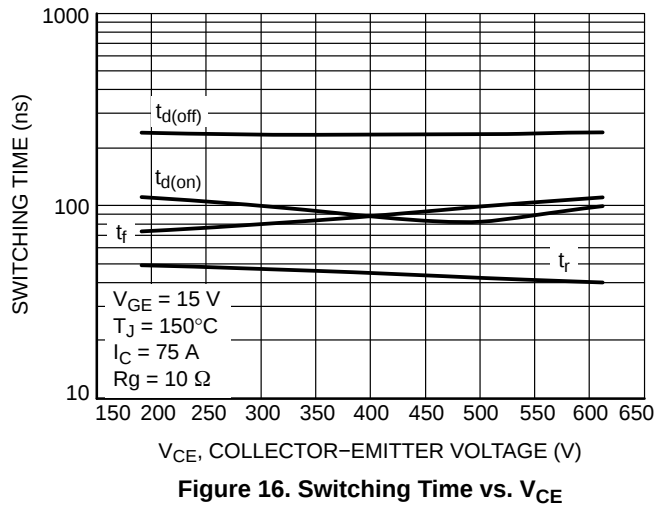
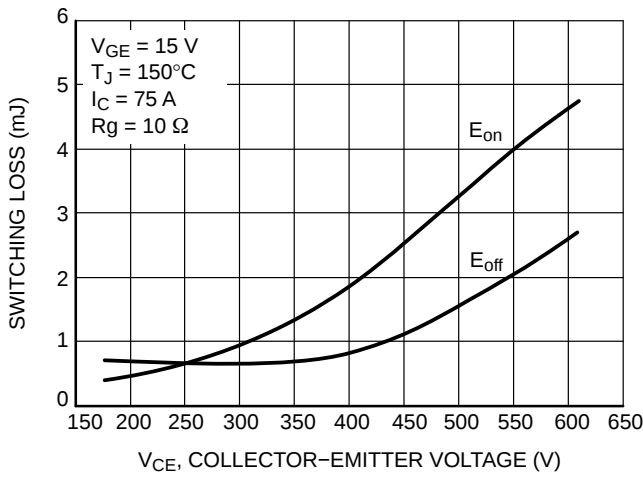
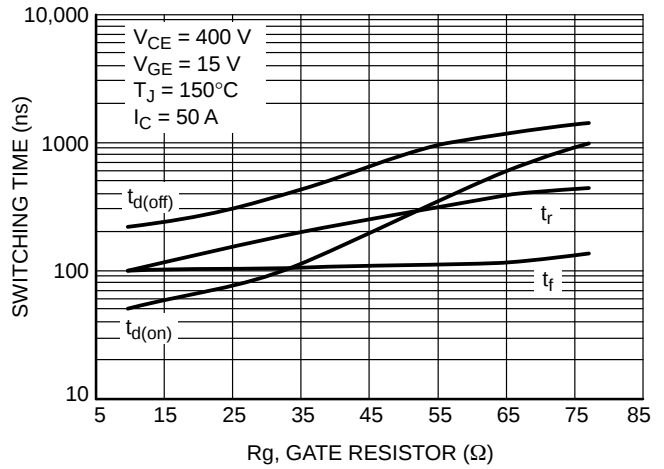
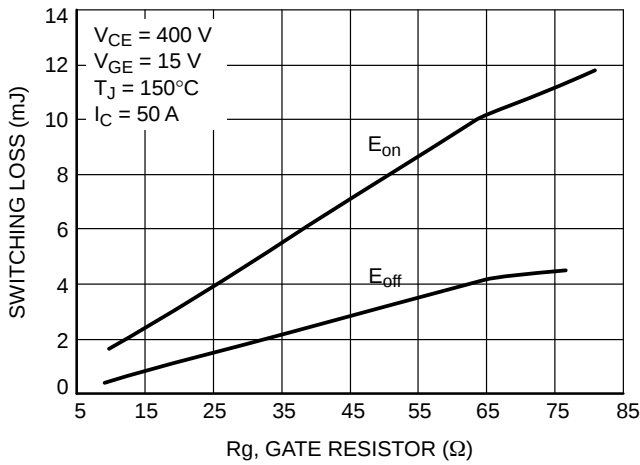


Figure 12. Switching Time vs. I_C

NGTB50N60FL2WG

TYPICAL CHARACTERISTICS



NGTB50N60FL2WG

TYPICAL CHARACTERISTICS

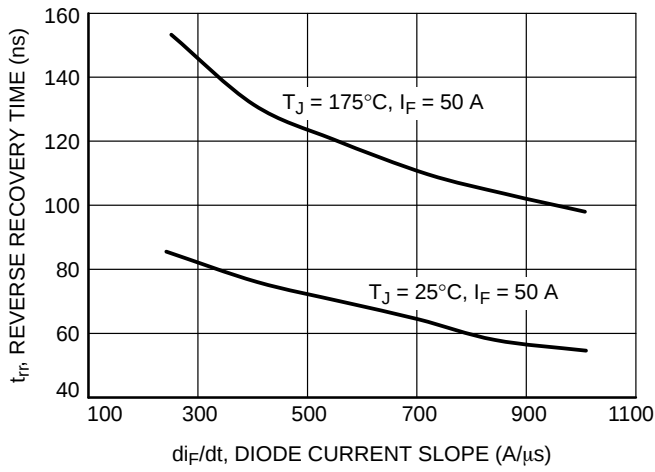


Figure 19. t_{rr} vs. di_F/dt
($V_R = 400\text{ V}$)

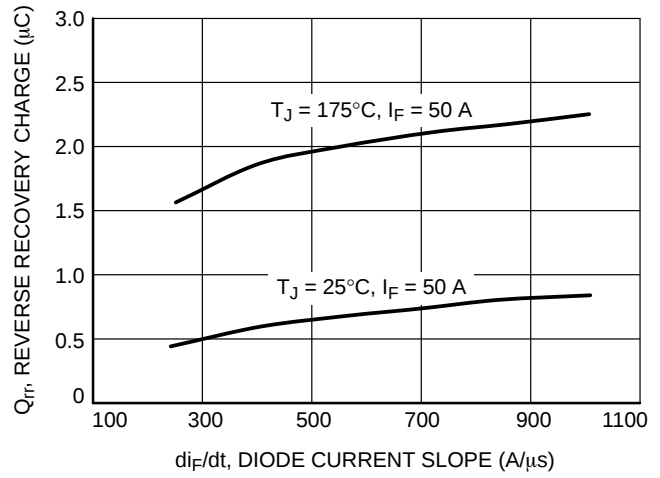


Figure 20. Q_{rr} vs. di_F/dt
($V_R = 400\text{ V}$)

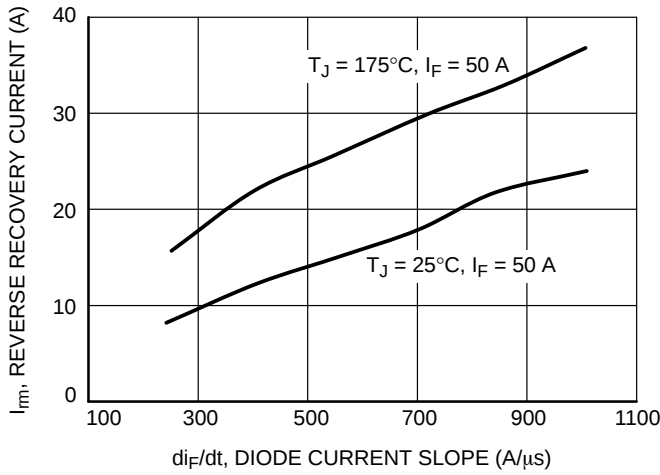


Figure 21. I_{rm} vs. di_F/dt
($V_R = 400\text{ V}$)

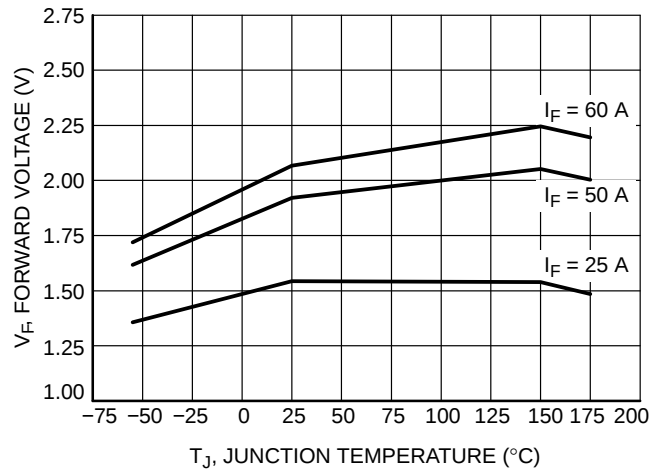


Figure 22. V_F vs. T_J

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TYPICAL CHARACTERISTICS

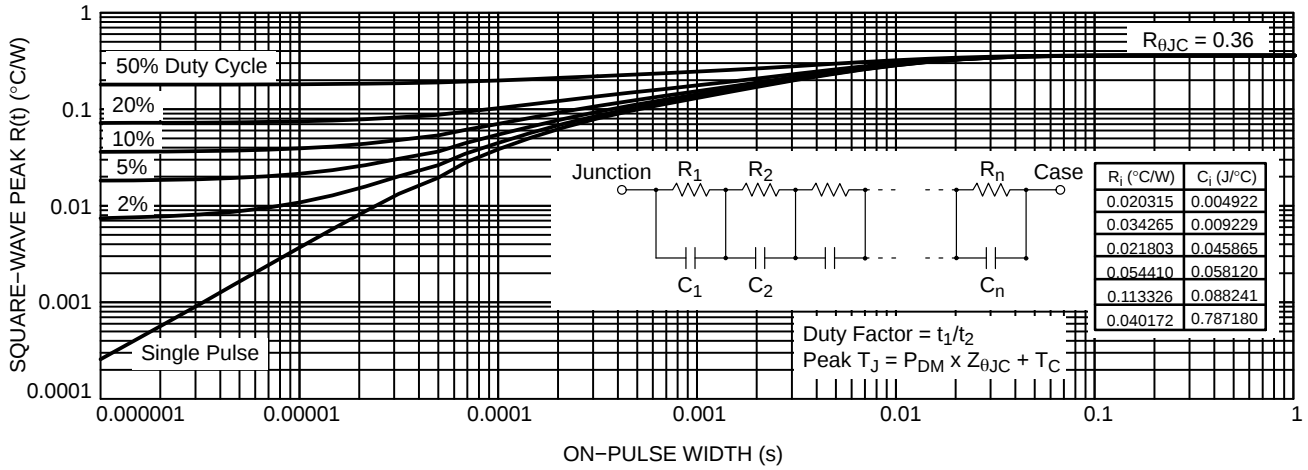


Figure 23. IGBT Transient Thermal Impedance

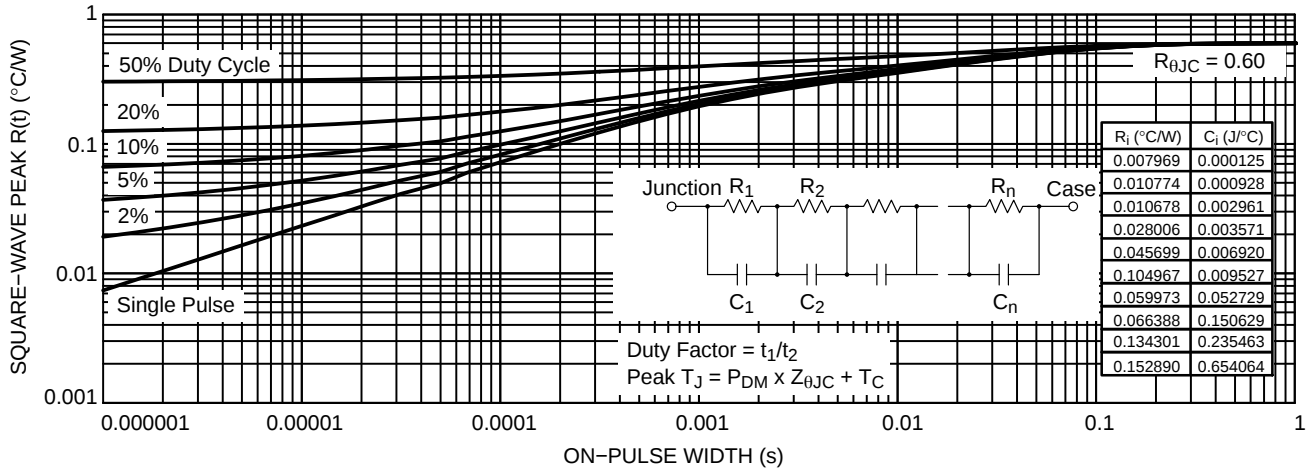


Figure 24. Diode Transient Thermal Impedance

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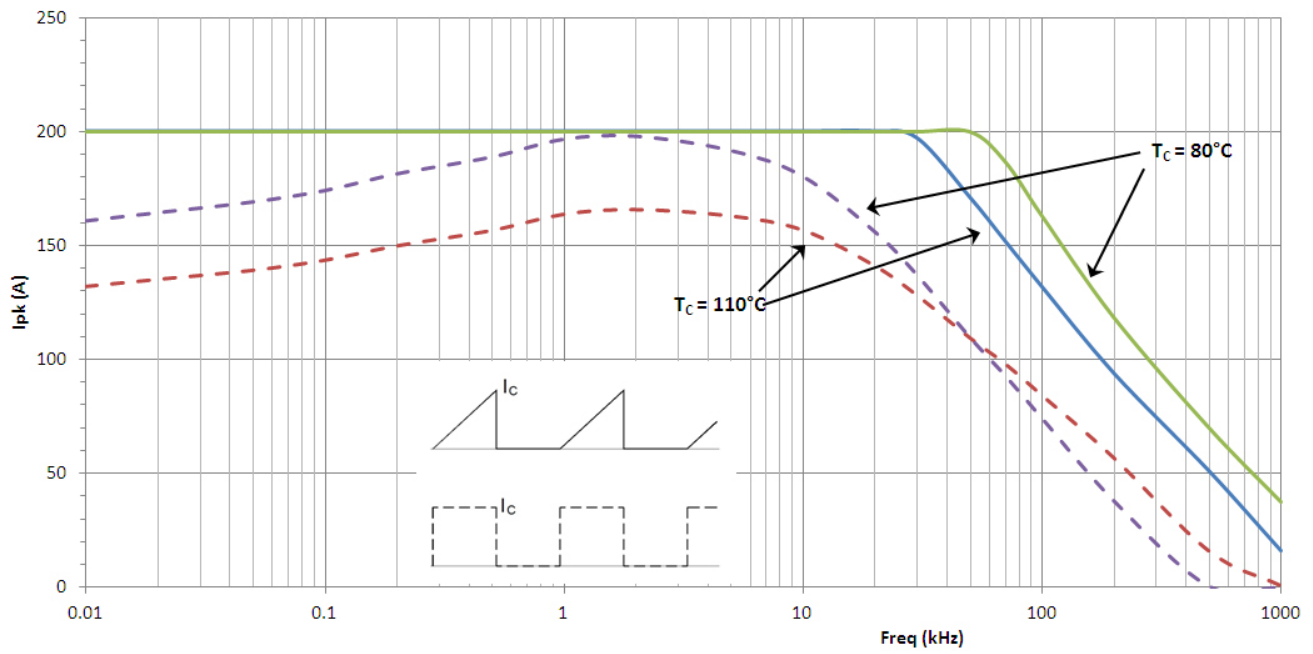


Figure 25. Collector Current vs. Switching Frequency

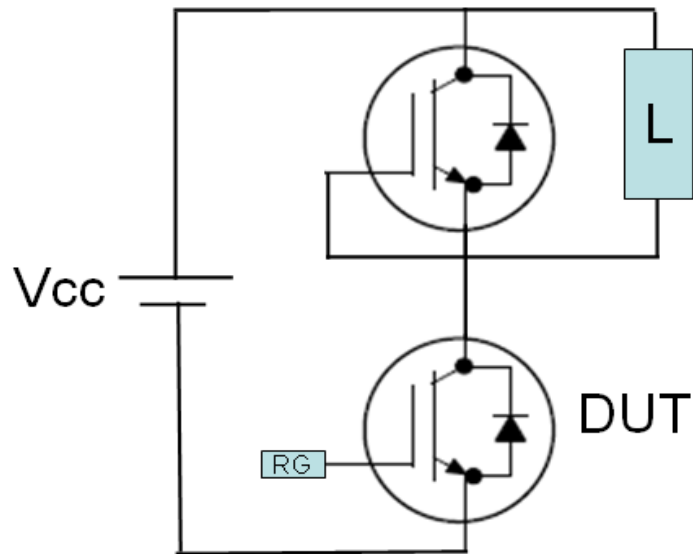


Figure 26. Test Circuit for Switching Characteristics

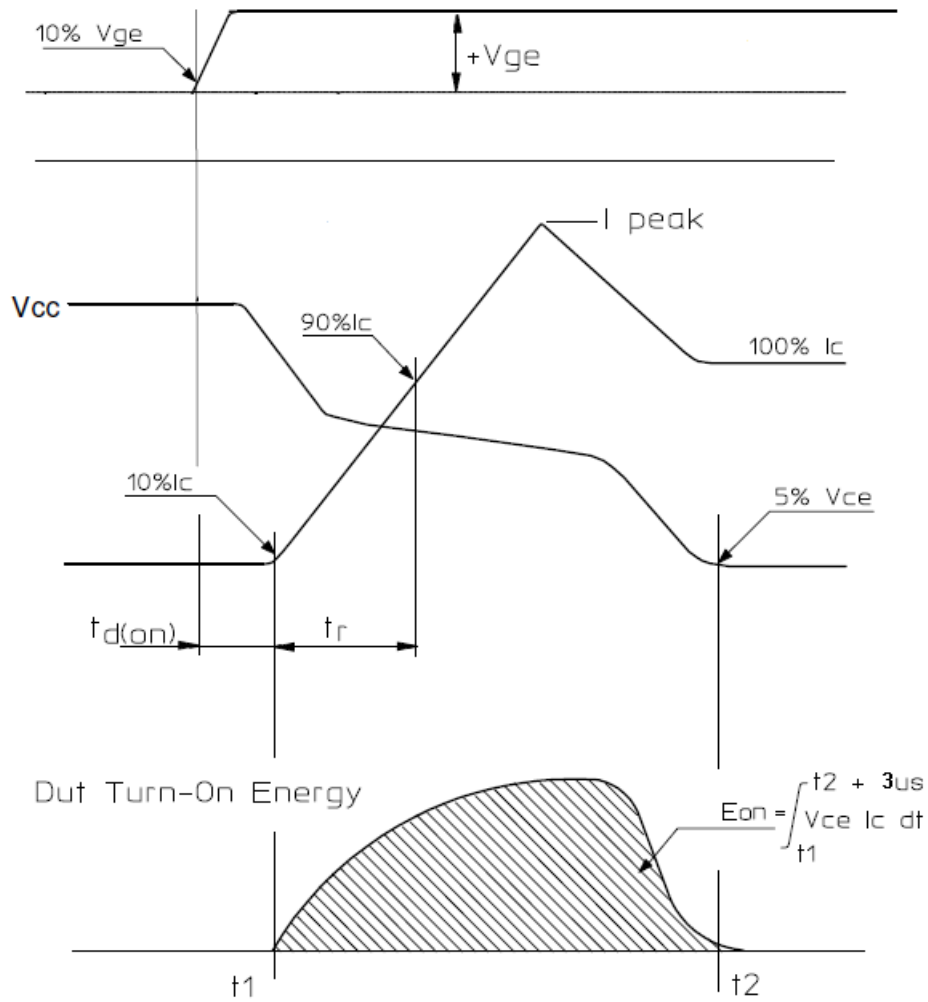


Figure 27. Definition of Turn On Waveform

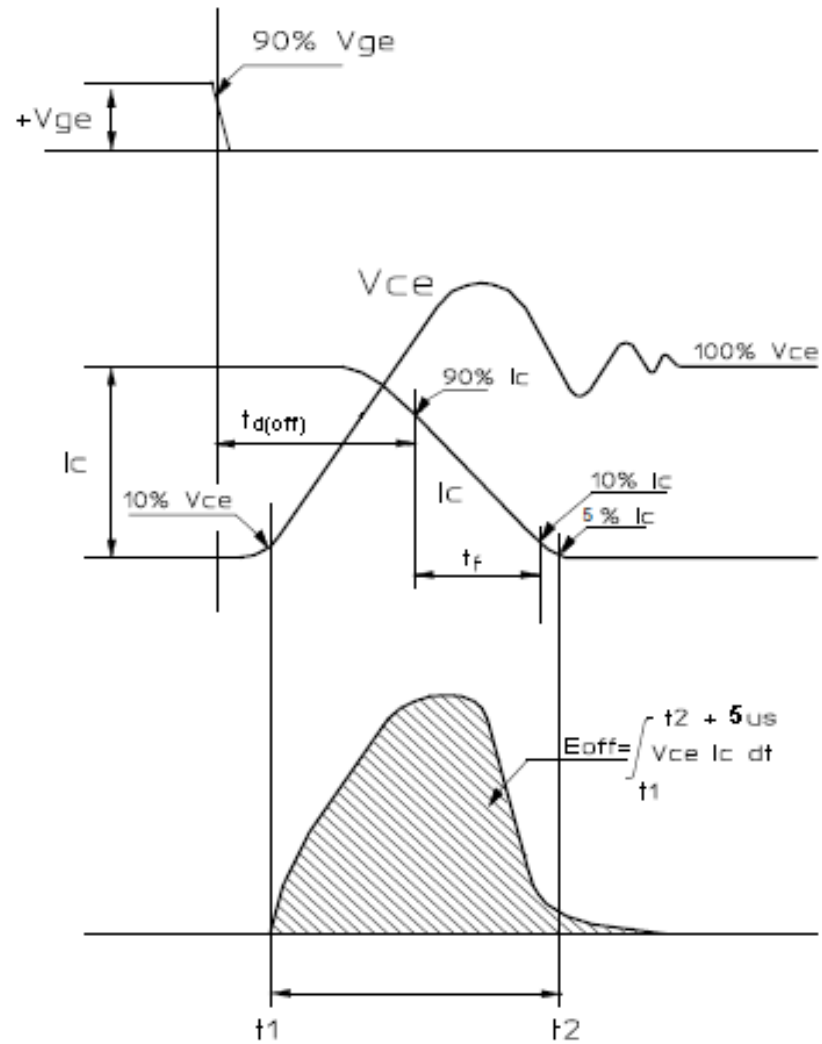
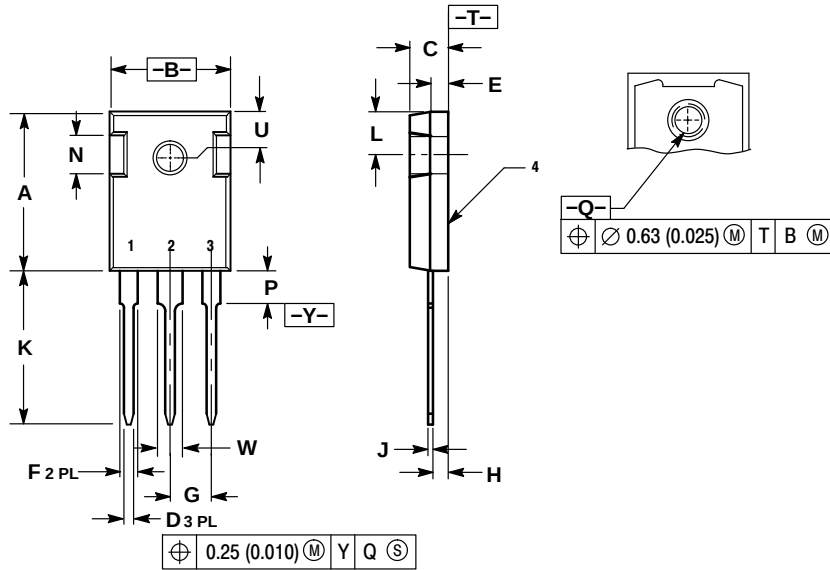


Figure 28. Definition of Turn Off Waveform

NGTB50N60FL2WG

PACKAGE DIMENSIONS

TO-247
CASE 340L-02
ISSUE F



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

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

- STYLE 4:
- PIN 1. GATE
 2. COLLECTOR
 3. EMITTER
 4. COLLECTOR

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