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NGTB45N60S1WG

IGBT - Inverter Welding

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. The IGBT is well suited for welding applications. Incorporated into the device is a soft and fast co−packaged free wheeling diode with a low forward voltage.

Features

- T_{Jmax} = 175°C
- Soft Fast Reverse Recovery Diode
- Optimized for High Speed Switching
- 5 μs Short−Circuit Capability
- These are Pb−Free Devices

Typical Applications

- Welding

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector−emitter voltage	V_{CES}	600	V
Collector current @ TC = 25°C @ TC = 100°C	I_C	 90 45	A
Diode Forward Current @ TC = 25°C @ TC = 100°C	I_F	 90 45	A
Diode Pulsed Current T_{PULSE} Limited by T_J Max	I_{FM}	180	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	180	A
Short−circuit withstand time V_{GE} = 15 V, V_{CE} = 400 V, $T_J \leq$ +150°C	t_{SC}	5	μs
Gate−emitter voltage	V_{GE}	±20	V
Transient gate−emitter voltage (T_{PULSE} = 5 μs, D < 0.10)		±30	V
Power Dissipation @ TC = 25°C @ TC = 100°C	P_D	 300 150	W
Operating junction temperature range	T_J	−55 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.

ON Semiconductor®

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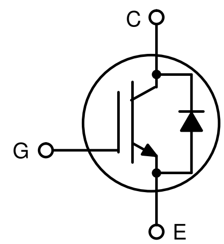
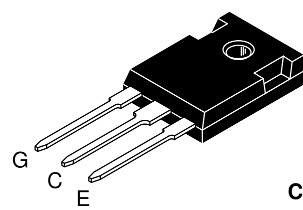
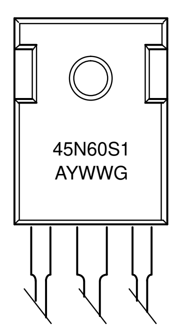
45 A, 600 V
V_{CEsat} = 2.00 V
E_{OFF} = 0.53 mJ





TO−247
CASE 340AL

MARKING DIAGRAM



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

ORDERING INFORMATION

Device	Package	Shipping
NGTB45N60S1WG	TO−247 (Pb−Free)	30 Units / Rail

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.50	°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 = 45 A V_{GE} = 15 V, I_C = 45 A, T_J = 175°C	V_{CEsat}	1.50 –	2.00 2.60	2.40 –	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 350 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 = 175°C	I_{CES}	– –	– –	0.5 4.0	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}	–	3115	–	pF
Output capacitance		C_{oes}	–	149	–	
Reverse transfer capacitance		C_{res}	–	88	–	
Gate charge total	V_{CE} = 480 V, I_C = 45 A, V_{GE} = 15 V	Q_g	–	125	–	nC
Gate to emitter charge		Q_{ge}	–	32	–	
Gate to collector charge		Q_{gc}	–	65	–	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 400 V, I_C = 45 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$	–	72	–	ns
Rise time		t_r	–	33	–	
Turn−off delay time		$t_{d(off)}$	–	132	–	
Fall time		t_f	–	68	–	
Turn−on switching loss		E_{on}	–	1.25	–	mJ
Turn−off switching loss		E_{off}	–	0.53	–	
Total switching loss		E_{ts}	–	1.78	–	
Turn−on delay time	T_J = 150°C V_{CC} = 400 V, I_C = 45 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$	–	70	–	ns
Rise time		t_r	–	38	–	
Turn−off delay time		$t_{d(off)}$	–	135	–	
Fall time		t_f	–	88	–	
Turn−on switching loss		E_{on}	–	1.59	–	mJ
Turn−off switching loss		E_{off}	–	0.88	–	
Total switching loss		E_{ts}	–	2.47	–	
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 45 A V_{GE} = 0 V, I_F = 45 A, T_J = 175°C	V_F	1.50 –	2.45 2.62	2.90 –	V
Reverse recovery time	T_J = 25°C I_F = 45 A, V_R = 200 V di_F/dt = 200 A/μs	t_{rr}	–	70	–	ns
Reverse recovery charge		Q_{rr}	–	272	–	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

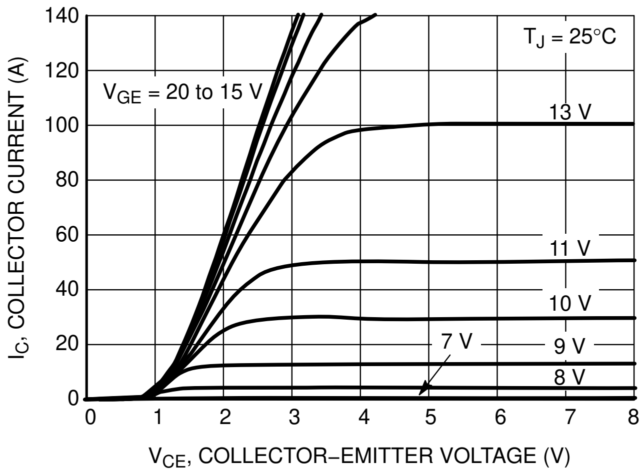


Figure 1. Output Characteristics

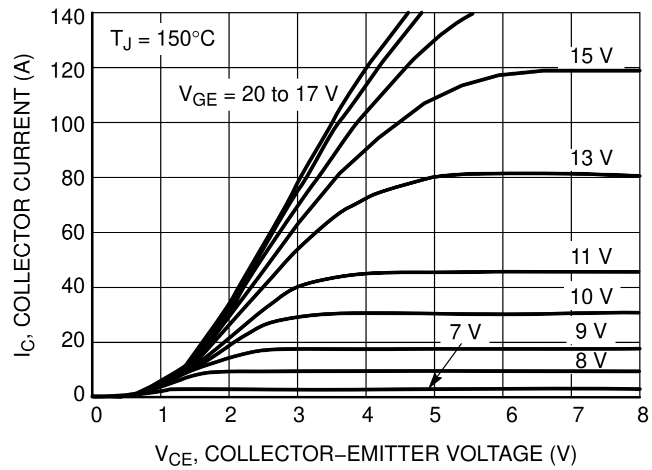


Figure 2. Output Characteristics

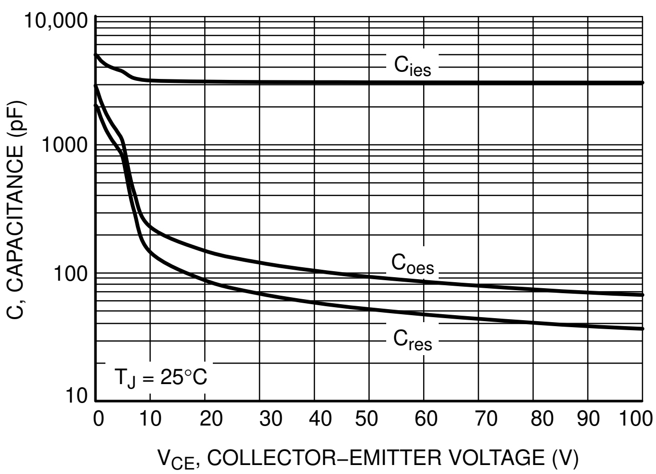


Figure 3. Typical Capacitance

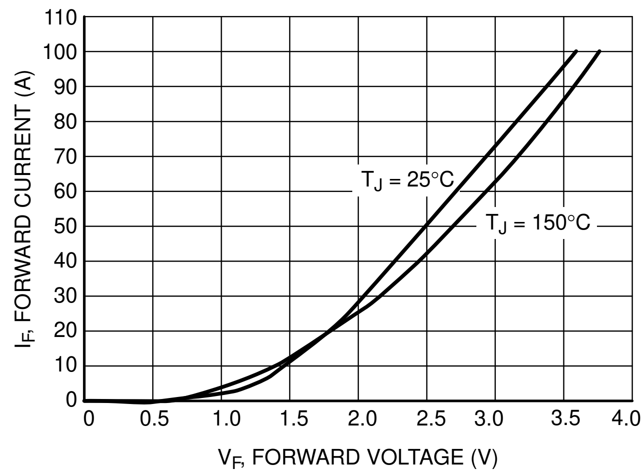


Figure 4. Diode Forward Characteristics

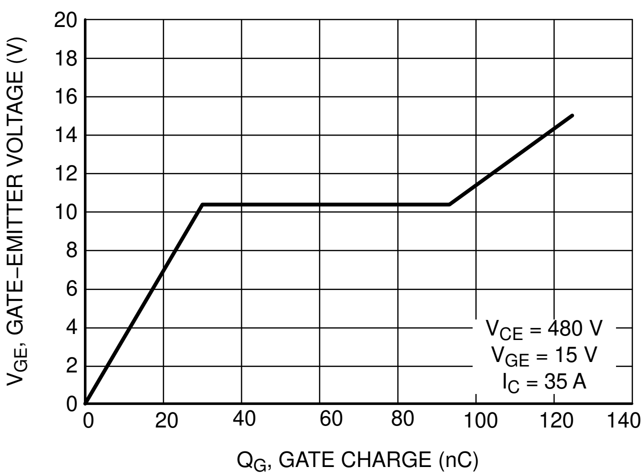


Figure 5. Typical Gate Charge

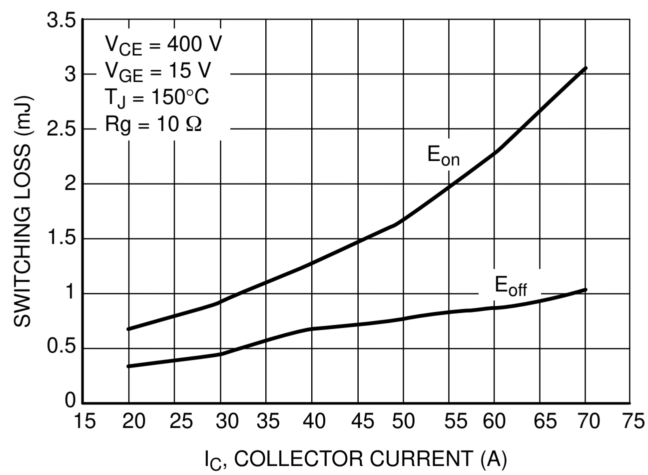


Figure 6. Switching Loss vs. I_C

TYPICAL CHARACTERISTICS

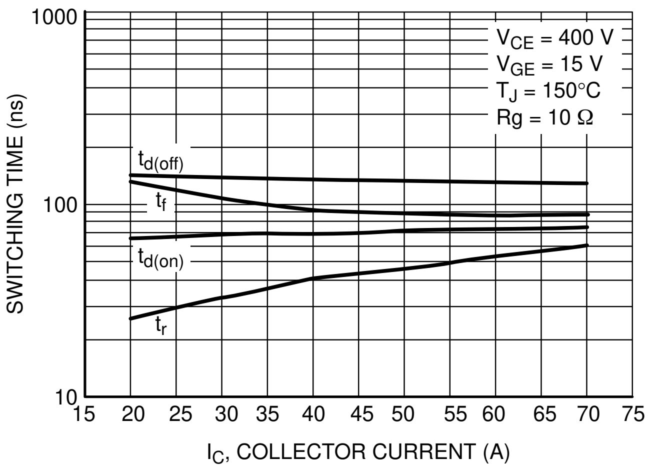


Figure 7. Switching Time vs. I_C

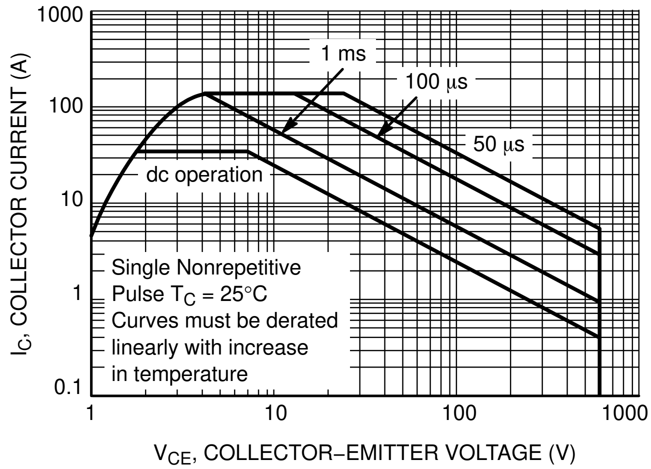
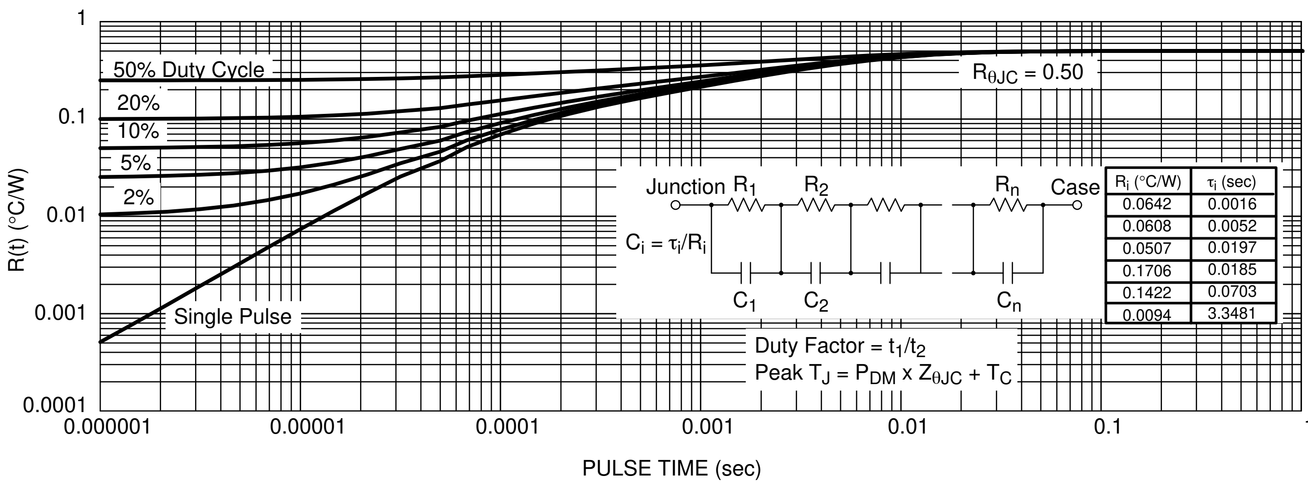
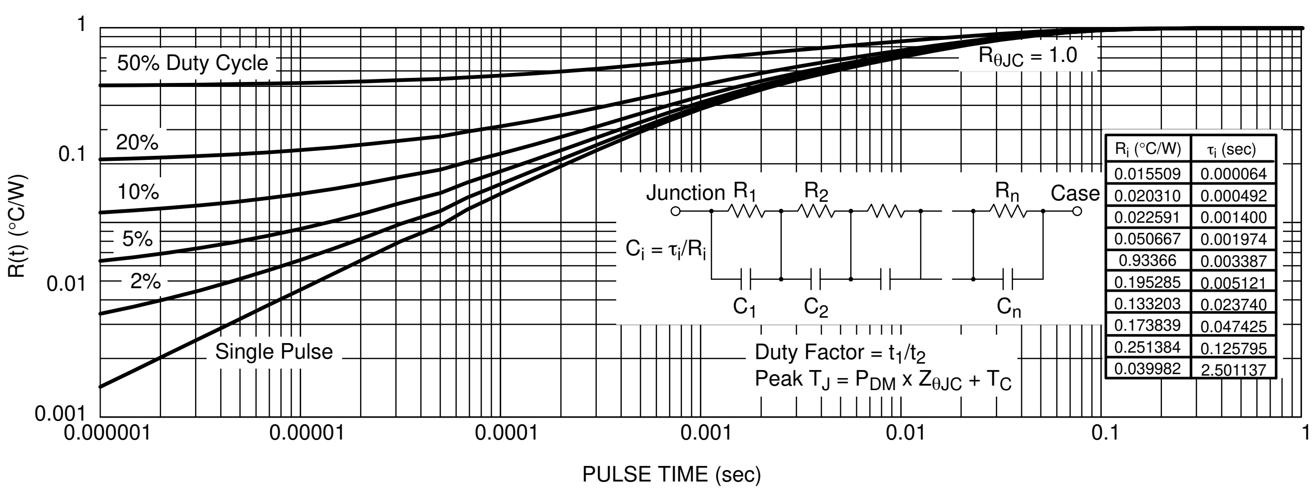


Figure 8. Safe Operating Area



R_i (°C/W)	τ_i (sec)
0.0642	0.0016
0.0608	0.0052
0.0507	0.0197
0.1706	0.0185
0.1422	0.0703
0.0094	3.3481

Figure 9. IGBT Transient Thermal Impedance



R_i (°C/W)	τ_i (sec)
0.015509	0.000064
0.020310	0.000492
0.022591	0.001400
0.050667	0.001974
0.93366	0.003387
0.195285	0.005121
0.133203	0.023740
0.173839	0.047425
0.251384	0.125795
0.039982	2.501137

Figure 10. Diode Transient Thermal Impedance

PACKAGE DIMENSIONS

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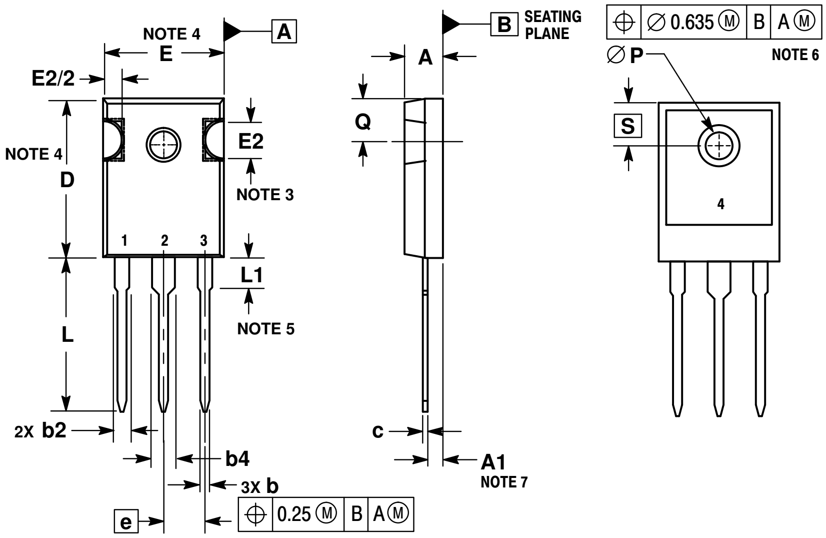
ISSUE A



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	1.00	1.40
b2	1.65	2.35
b4	2.60	3.40
c	0.40	0.80
D	20.30	21.40
E	15.50	16.25
E2	4.32	5.49
e	5.45 BSC	
L	19.80	20.80
L1	3.50	4.50
P	3.55	3.65
Q	5.40	6.20
S	6.15 BSC	

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