

NGTB20N60T2TF1

Advance Information

IGBT with Low V_F Switching Diode 600 V, 20 A, $V_{CE(sat)}$; 1.45 V, N-Channel



ON Semiconductor®

www.onsemi.com

This Insulated Gate Bipolar Transistor (IGBT) features a robust and Field Stop (FS) Trench construction, and provides superior performance in demanding switching applications, offering both low on state voltage and minimal switching loss.

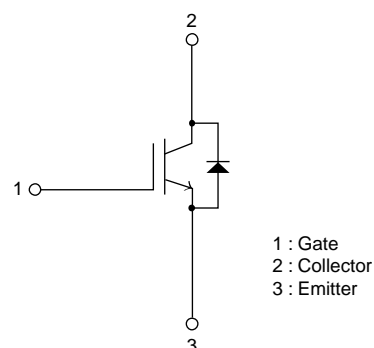
Features

- IGBT $V_{CE(sat)}$ = 1.45 V typ. (I_C = 20 A, V_{GE} = 15 V)
- IGBT t_f = 75 ns typ.
- Diode V_F = 1.5 V typ. (I_F = 20 A)
- Diode t_{rr} = 80 ns typ.
- Adaption of full isolation type package
- Enhancement type
- Maximum junction temperature T_j = 150°C
- Pb-Free, Halogen Free and RoHS compliance

Typical Applications

- Power factor correction of white goods appliance
- General purpose inverter

ELECTRICAL CONNECTION N-Channel



SPECIFICATIONS

ABSOLUTE MAXIMUM RATING at T_a = 25°C, Unless otherwise specified (Notes 1, 2, 3)

Parameter	Symbol	Value	Unit
Collector to Emitter Voltage	V_{CES}	600	V
Gate to Emitter Voltage	V_{GES}	±30	V
Collector Current (Note 2) Limited by T_{jmax} @ T_c = 25°C (Note 3)	I_C	40	A
Collector Current (Note 2) Limited by T_{jmax} @ T_c = 100°C (Note 3)		20	A
Collector Current Pulse @ T_c = 100°C (Note 4)		30	A
Collector Current (Pulse) Pulse width Limited by T_{jmax}	I_{CP}	105	A
Diode Average Output Current	I_O	20	A
Power Dissipation T_c = 25°C (Note 3) (Our ideal heat dissipation condition)	P_D	56	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	-55 to +150	°C

Note 1 : 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.

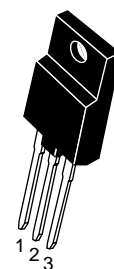
2 : Pulse width limited by forward bias SOA.

3 : Our condition is radiation from backside.

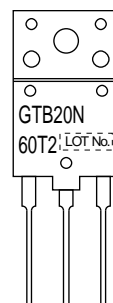
The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

4 : Limited by maximum junction temperature.

MARKING



TO-3PF-3L
CASE 340AH



ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

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ELECTRICAL CHARACTERISTICS at Ta = 25°C Unless otherwise specified (Note 5)

Parameter	Symbol	Conditions	Value			Unit
			min	typ	max	

STATIC CHARACTERISTIC

Collector to Emitter Breakdown Voltage	V(BR)CES	IC = 500 μ A, VGE = 0 V	600			V
Collector to Emitter Saturation Voltage	VCE (sat)	VGE = 15 V IC = 20 A		1.45	1.7	V
		Tc = 150°C		1.75		V
Gate to Emitter Threshold Voltage	VGE(th)	VCE = 20 V, IC = 200 μ A	4.0		7.0	V
Collector to Emitter Cut off Current	ICES	VCE = 600 V VGE = 0 V			10	μ A
		Tc = 150°C			1.0	mA
Gate to Emitter Leakage Current	IGES	VGE = \pm 30 V, VCE = 0 V			\pm 100	nA

DYNAMIC CHARACTERISTIC

Input Capacitance	Cies	VCE = 20 V, f = 1 MHz		1,150		pF
Output Capacitance	Coes			65		pF
Reverse Transfer Capacitance	Cres			16		pF
Total Gate Charge	Qg	VCE = 300 V, VGE = 15 V, IC = 20 A		35		nC
Gate to Emitter Charge	Qge			8.6		nC
Gate to Collector "Miller" Charge	Qgc			12		nC

SWITCHING CHARACTERISTIC, INDUCTIVE LOAD

Turn-ON Delay Time	td(on)	Tc = 25°C VCC = 300 V, IC = 20 A RG = 30 Ω , L = 200 μ H VGE = 0 V / 15 V Vclamp = 400 V See Fig.1, Fig.2		45		ns
Rise Time	tr			32		ns
Turn-ON Time	ton			135		ns
Turn-OFF Delay Time	td(off)			105		ns
Fall Time	tf			75		ns
Turn-OFF Time	toff			175		ns
Turn-ON Energy	Eon			0.32		mJ
Turn-OFF Energy	Eoff			0.33		mJ
Turn-ON Delay Time	td(on)	Tc = 100°C VCC = 300 V, IC = 20 A RG = 30 Ω , L = 200 μ H VGE = 0 V / 15 V Vclamp = 400 V See Fig.1, Fig.2		50		ns
Rise Time	tr			41		ns
Turn-ON Time	ton			152		ns
Turn-OFF Delay Time	td(off)			110		ns
Fall Time	tf			92		ns
Turn-OFF Time	toff			220		ns
Turn-ON Energy	Eon			0.35		mJ
Turn-OFF Energy	Eoff			0.49		mJ

DIODE CHARACTERISTIC

Diode Forward Voltage	VF	IF = 20 A	Tc = 25°C		1.5	V
			Tc = 100°C		1.55	V
Diode Reverse Recovery Time	trr	Tc = 25°C IF = 10 A, di/dt = 100 A/ μ s, VCC = 50 V See Fig.3			80	ns
		Tc = 100°C IF = 10 A, di/dt = 100 A/ μ s, VCC = 50 V See Fig.3			95	ns

Note 5 : 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.

THERMAL CHARACTERISTICS at Ta = 25°C, Unless otherwise specified (Note 6)

Parameter	Symbol	Conditions	Value	Unit
Thermal Resistance IGBT (junction- case)	Rth(j-c) (IGBT)	Tc = 25°C (Note 6) (our ideal heat dissipation condition)	2.20	°C/W
Thermal Resistance Diode (junction- case)	Rth(j-c) (Diode)	Tc = 25°C (Note 6) (our ideal heat dissipation condition)	2.36	°C/W
Thermal Resistance (junction- atmosphere)	Rth(j-a)		47.5	°C/W

Note 6 : Our condition is radiation from backside. The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

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Fig.1 Switching Time Test Circuit

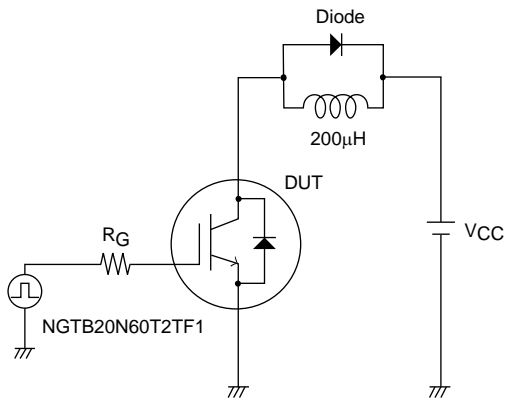


Fig.2 Timing Chart

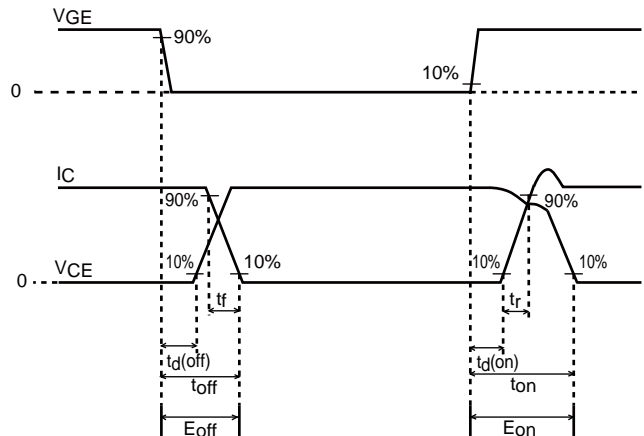
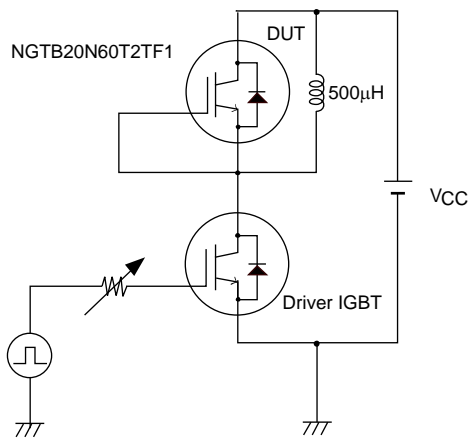
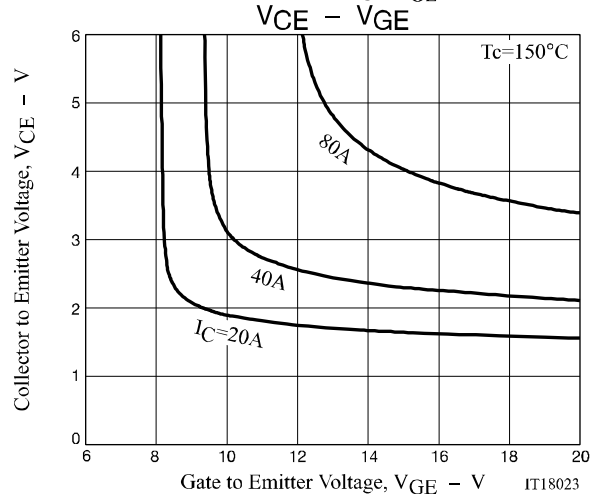
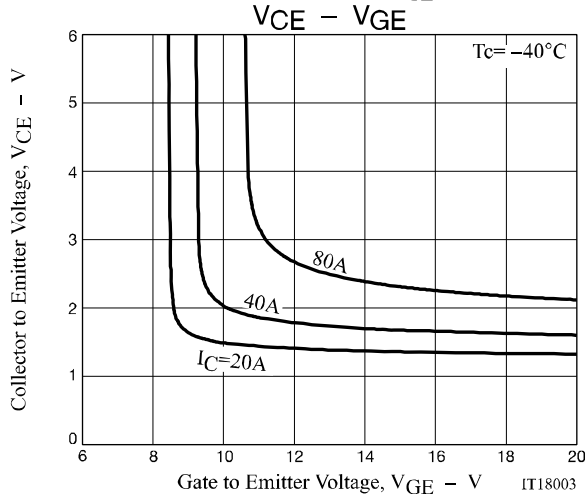
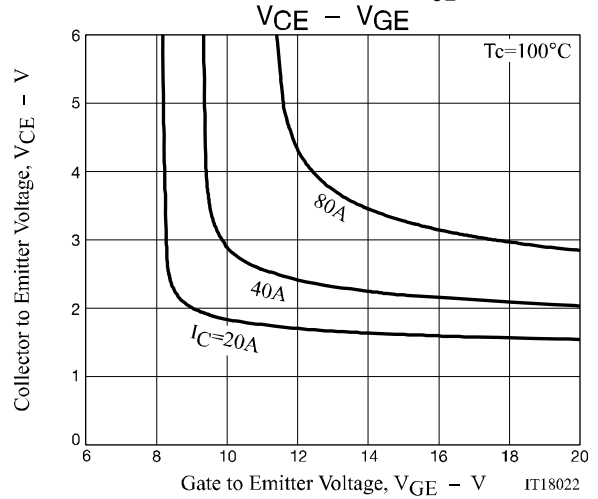
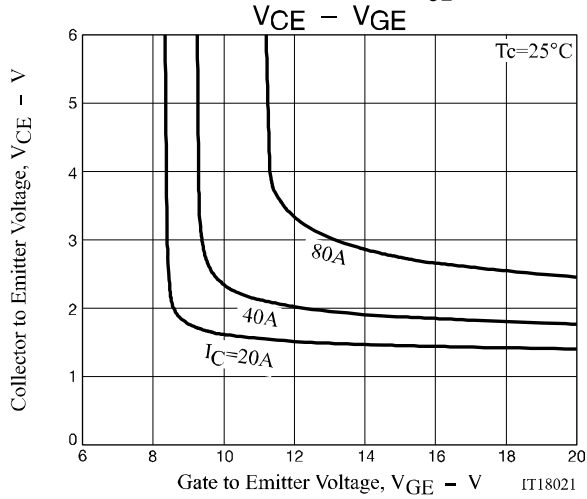
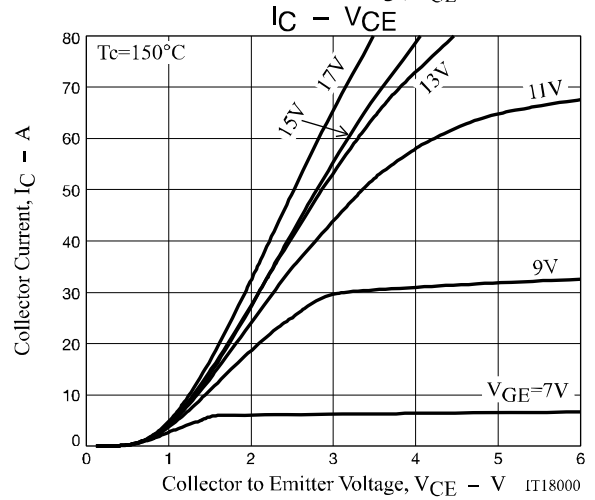
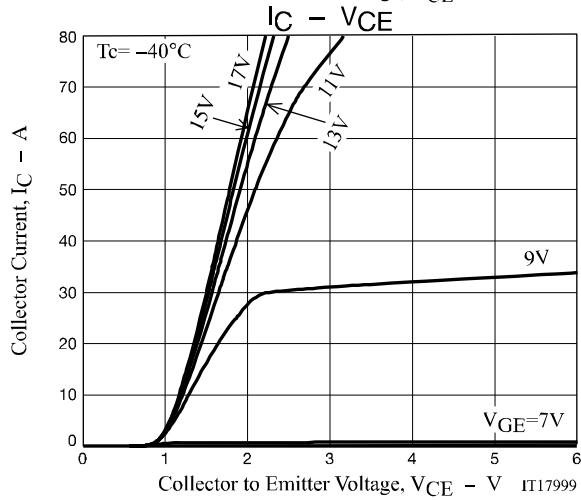
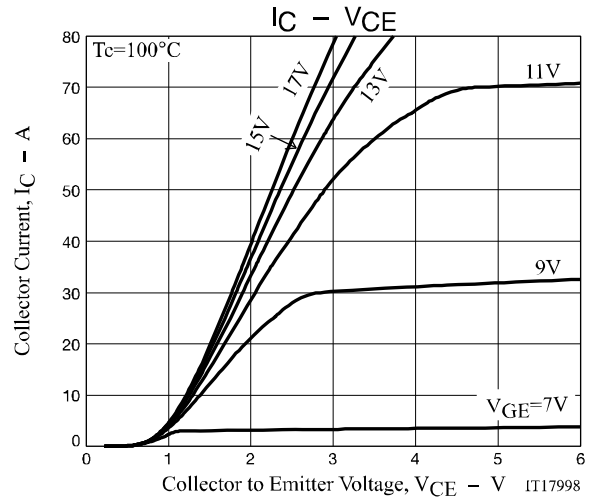
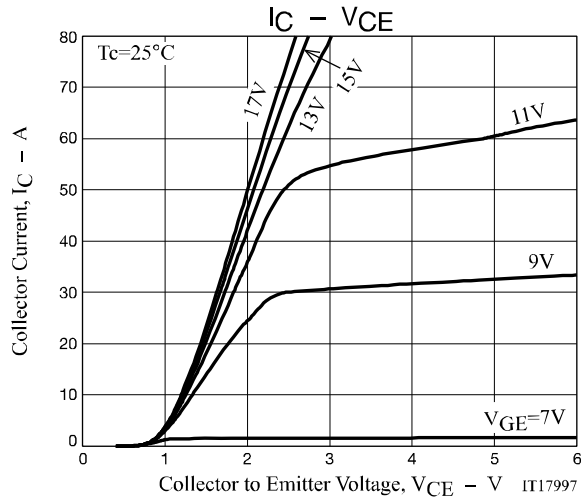


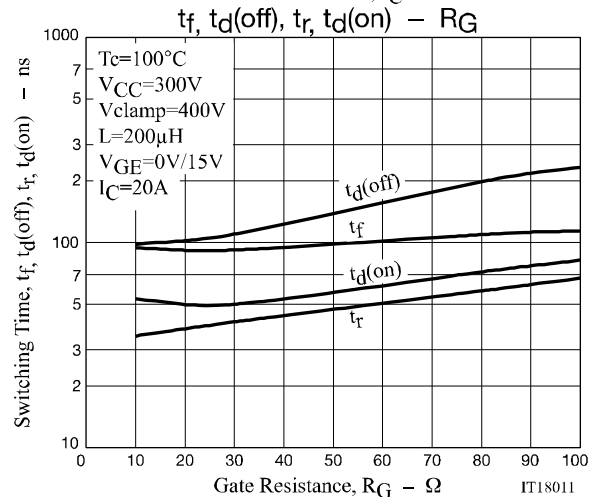
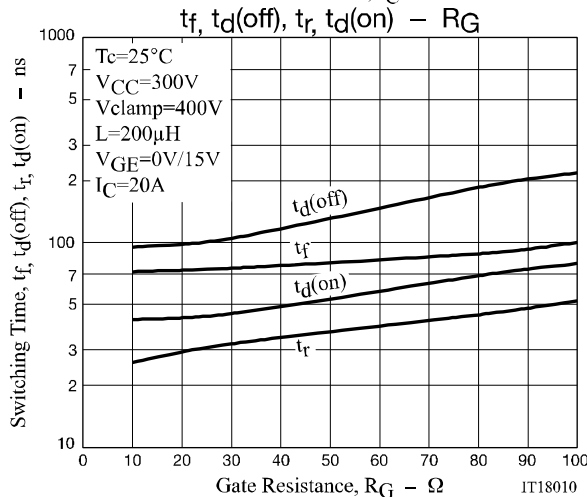
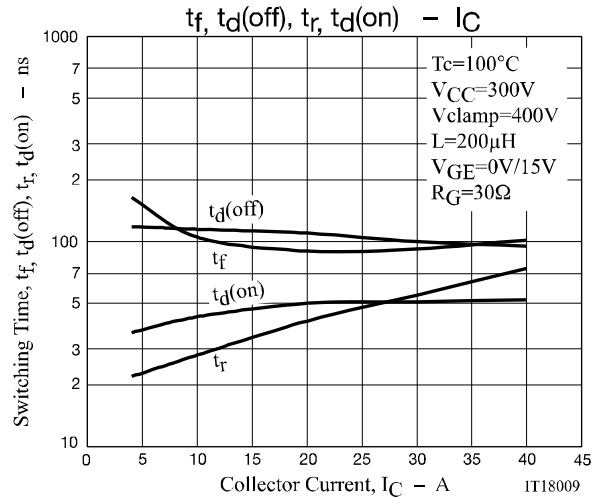
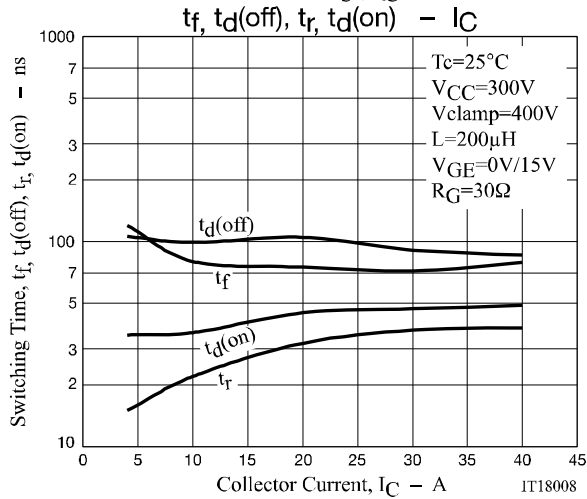
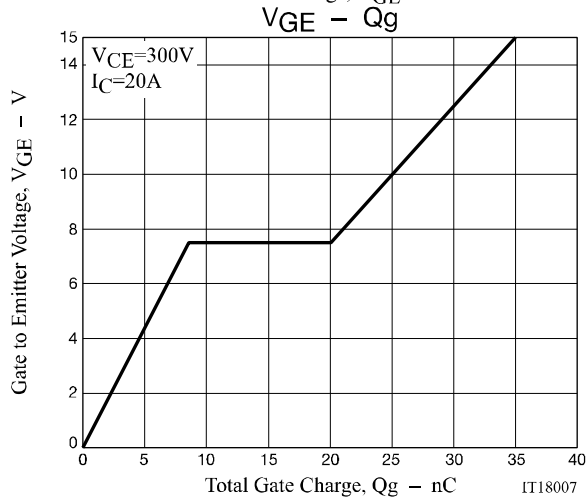
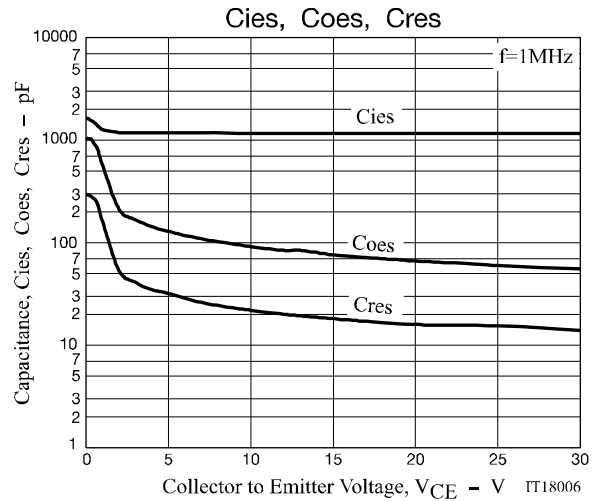
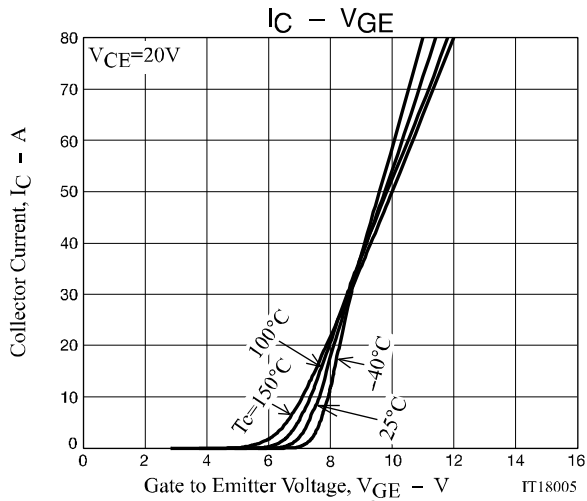
Fig.3 Reverse Recovery Time Test Circuit



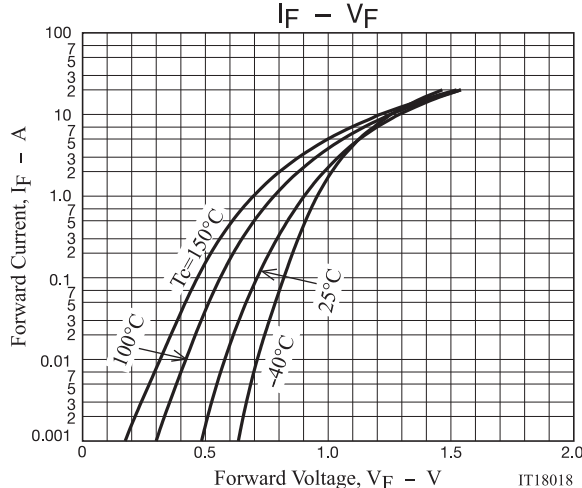
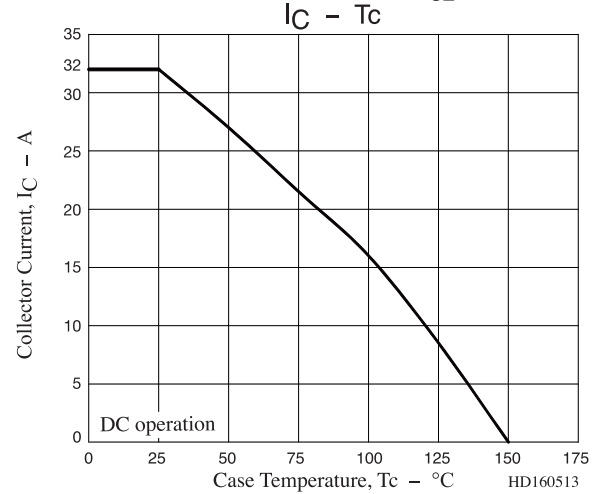
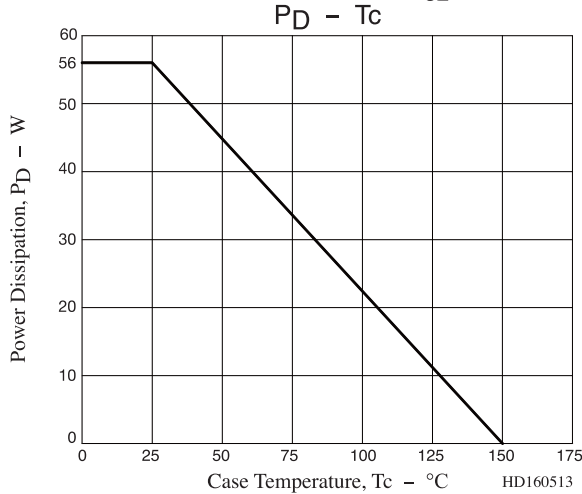
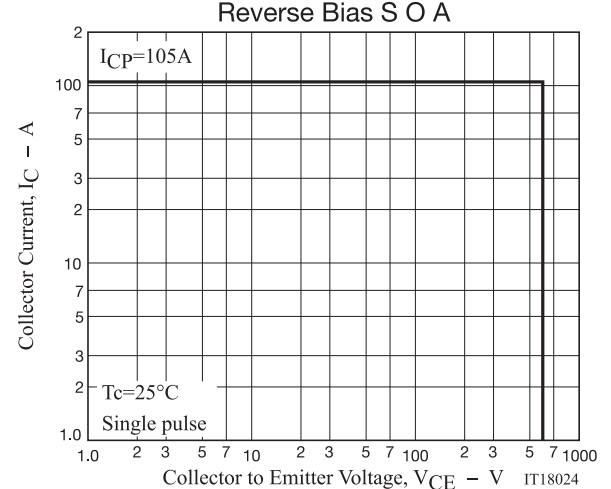
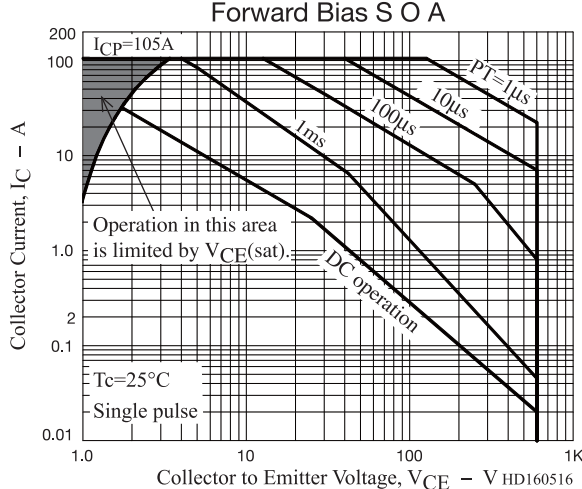
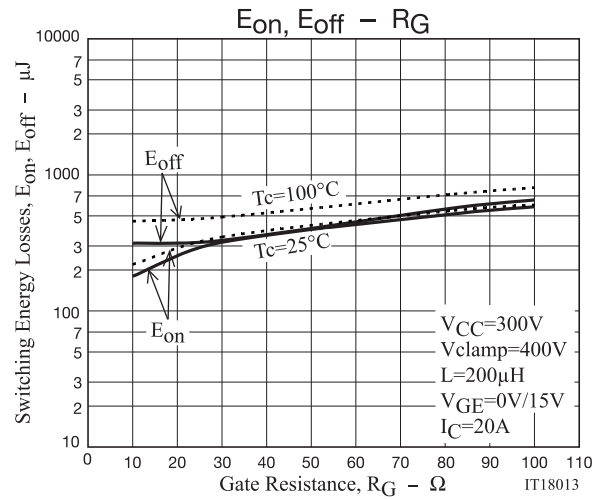
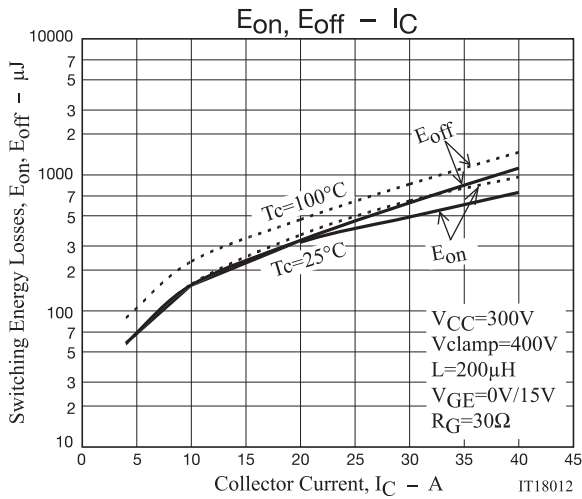
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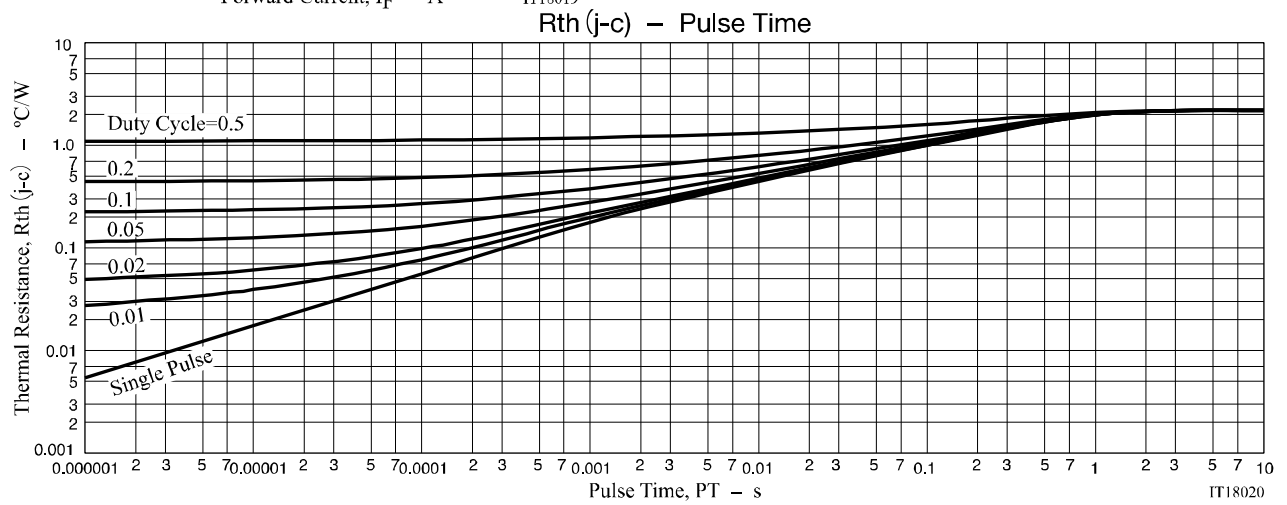
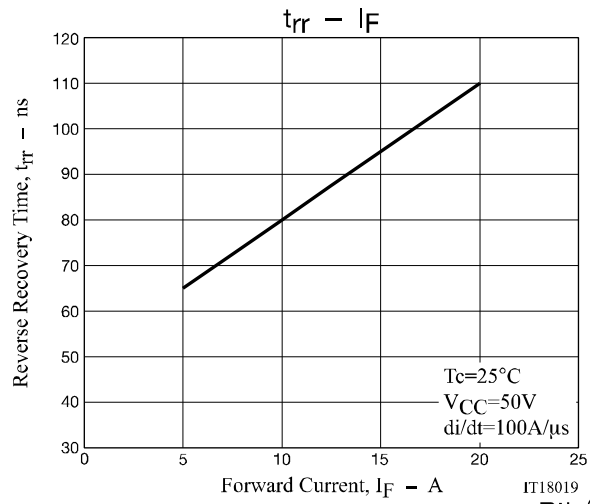
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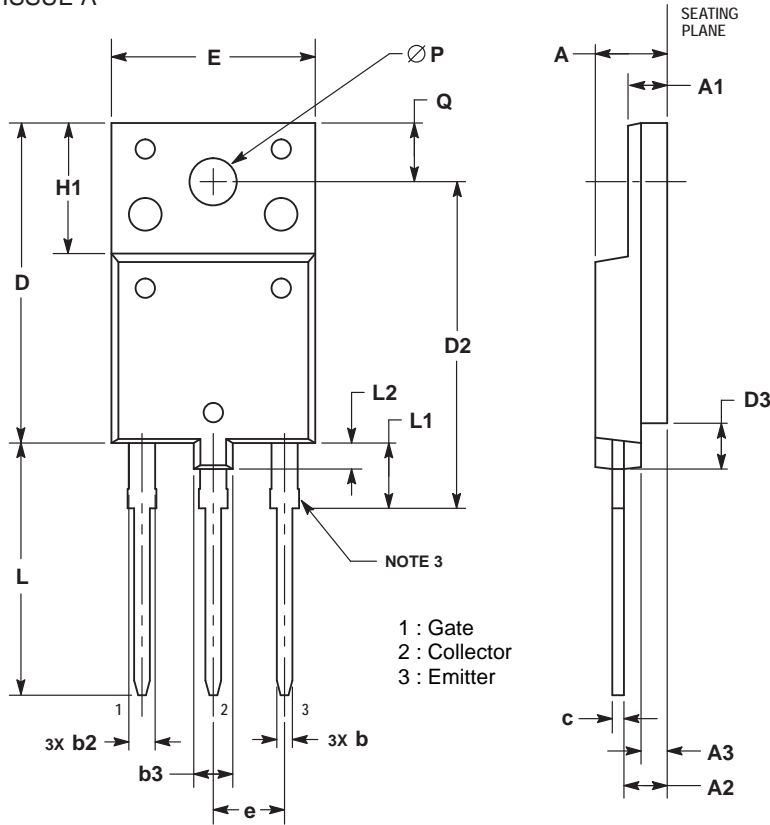
PACKAGE DIMENSIONS

unit : mm

TO-3PF-3L

CASE 340AH

ISSUE A



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR UNCONTROLLED IN THIS AREA (6 PLACES).
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.20.

DIM	MILLIMETERS	
	MIN	MAX
A	5.30	5.70
A1	2.80	3.20
A2	3.10	3.50
A3	1.80	2.20
b	0.65	0.95
b2	1.90	2.15
b3	3.80	4.20
c	0.80	1.10
D	24.30	24.70
D2	24.70	25.30
D3	3.30	3.70
E	15.30	15.70
e	5.35	5.55
H1	9.80	10.20
L	19.10	19.50
L1	4.80	5.20
L2	1.90	2.20
P	3.40	3.80
Q	4.30	4.70

ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing)
NGTB20N60T2TF1G	GTB20N60T2	TO-3PF-3L (Pb-Free / Halogen Free)	30 / Tube

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