Ordering number : ENA2196

NGTB20N60L2TF1G

N-Channel IGBT
600V, 20A, V_{CE}(sat);1.45V TO-3PF-3L with Low V_F Switching Diode

ON Semiconductor®

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Features

- IGBT V_{CE}(sat)=1.45V typ. (I_C=20A, V_{GE}=15V)
- IGBT t_f=67ns typ.
- Diode V_F=1.5V typ. (I_F=20A)
- Diode t_{rr}=70ns typ.
- Adaption of full isolation type package
- Enhansment type
- Maxium junction temperature Tj=175°C

Applications

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

Specifications

Absolute Maximum Ratings at Ta = 25°C, Unless otherwise specified

Parameter	Symbol	Conditions		Ratings	Unit
Collector to Emitter Voltage	V_{CES}			600	V
Gate to Emitter Voltage	V_{GES}			±20	V
Collector Current (DC)	I_C*1	Limited by Tjmax	@ Tc=25°C *2	40	A
			@ Tc=100°C *2	20	A
Collector Current (Pulse)	I_{CP}	Pulse width Limited by Tjmax		80	A
Diode Average Output Current	I_O			20	A
Allowable Power Dissipation	P_D	Tc=25°C (Our ideal heat dissipation condition) *2		64	W

Note : *1 Collector Current is calculated from the following formula.

Continued on next page.

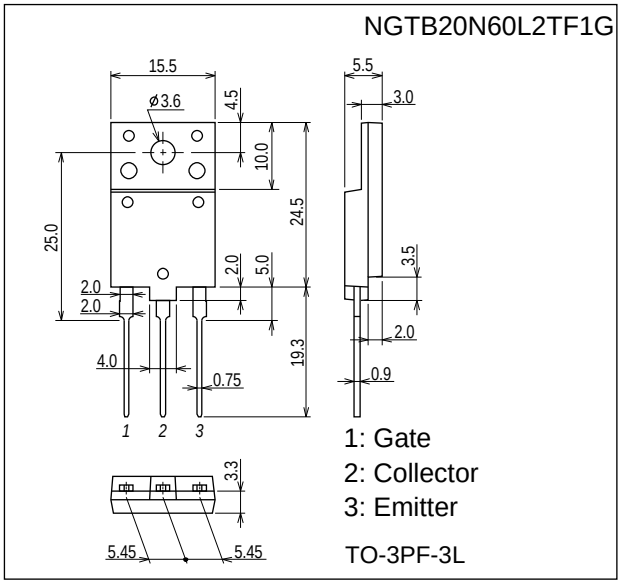
$$I_C(Tc)= \frac{Tjmax - Tc}{R_{th}(j\text{-}c)\times V_{CE}(sat)(Tjmax, I_C(Tc))}$$

*2 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 aluminium.

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.

Package Dimensions

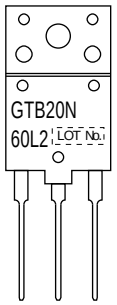
unit : mm (typ) 7538-001



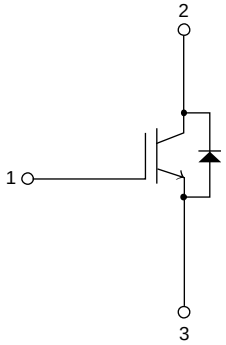
Ordering & Package Information

Device	Package	Shipping	note
NGTB20N60L2TF1G	TO-3PF-3L SC-94	30 pcs. / tube	Pb-Free

Marking



Electrical Connection



Continued from preceding page.

Parameter	Symbol	Conditions	Ratings	Unit
Junction Temperature	Tj		175	°C
Storage Temperature	Tstg		- 55 to +175	°C

Electrical Characteristics at Ta = 25°C, Unless otherwise specified

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector to Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C=500μA, V_{GE}=0V	600			V
Collector to Emitter Cut off Current	I_{CES}	V_{CE}=600V, V_{GE}=0V Tc=25°C			10	μA
		Tc=150°C			1	mA
Gate to Emitter Leakage Current	I_{GES}	V_{GE}=±20V, V_{CE} =0V			±100	nA
Gate to Emitter Threshold Voltage	V_{GE}(th)	V_{CE} =20V, I_C=250μA	4.5		6.5	V
Collector to Emitter Saturation Voltage	V_{CE} (sat)	V_{GE}=15V, I_C=20A Tc=25°C		1.45	1.65	V
		Tc=150°C		1.8		V
Diode Forward Voltage	V_F	I_F=20A		1.5		V
Input Capacitance	Cies	V_{CE} =20V,f=1MHz		2000		pF
Output Capacitance	Coes			60		pF
Reverse Transfer Capacitance	Cres			50		pF
Turn-ON Delay Time	t_d(on)	V_{CC}=300V,I_C=20A R_G=30Ω,L=200μH V_{GE}=0V/15V, Vclamp=400V See Fig.1, Fig.2		60		ns
Rise Time	t_r			37		ns
Turn-ON Time	ton			400		ns
Turn-OFF Delay Time	t_d(off)			193		ns
Fall Time	t_f			67		ns
Turn-OFF Time	toff			281		ns
Total Gate Charge	Qg	V_{CE} =300V, V_{GE}=15V, I_C=20A		84		nC
Gate to Emitter Charge	Qge			16		nC
Gate to Collector “Miller” Charge	Qgc			37		nC
Diode Reverse Recovery Time	t_{rr}	I_F=10A , di/dt=100A/μs, V_{CC}=50V See Fig.3		70		ns

Thermal Characteristics at Ta = 25°C, Unless otherwise specified

Parameter	Symbol	Conditions	Ratings	Unit
Thermal Resistance IGBT (junction- case)	Rth(j-c)(IGBT)	Tc=25°C (our ideal heat dissipation condition)*2	2.33	°C /W
Thermal Resistance Diode (junction- case)	Rth(j-c)(Diode)	Tc=25°C (our ideal heat dissipation condition)*2	2.36	°C /W
Thermal Resistance (junction- atmosphere)	Rth(j-a)		47.5	°C /W

Fig.1 Switching Time Test Circuit

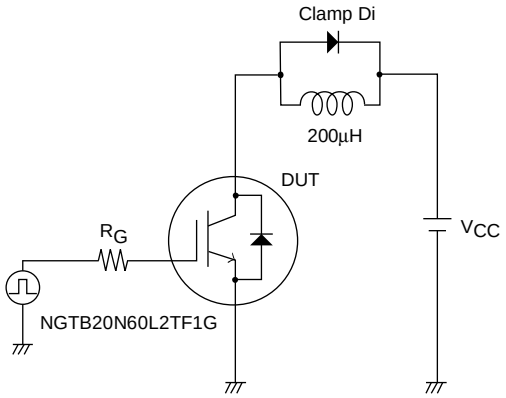


Fig.2 Timing Chart

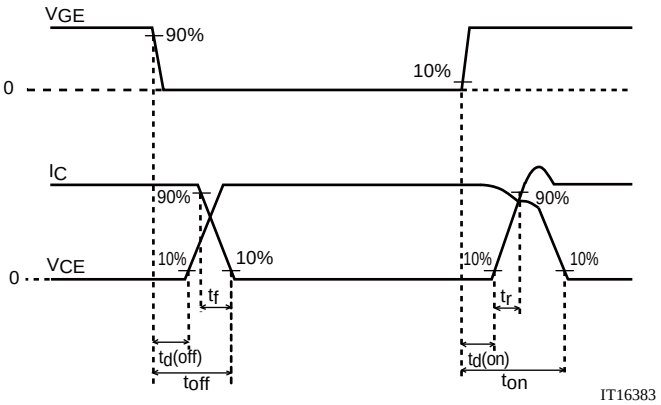
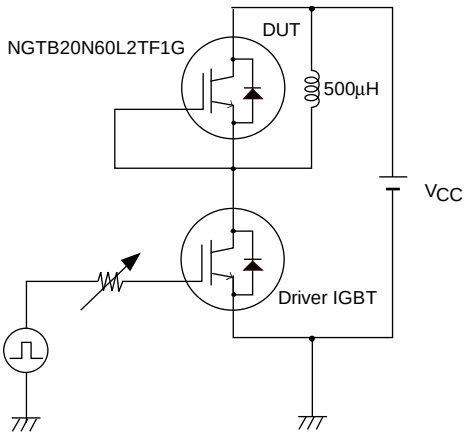
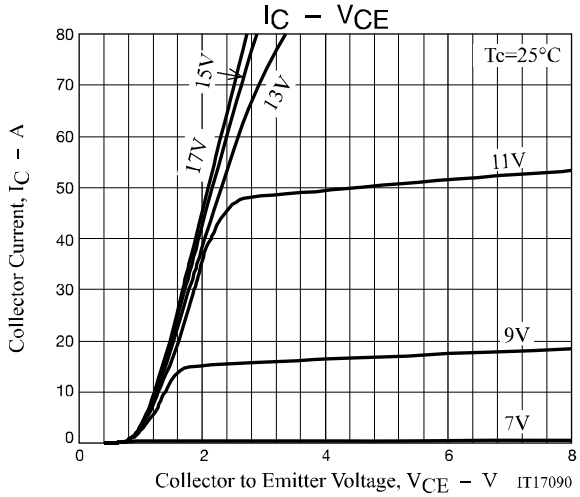
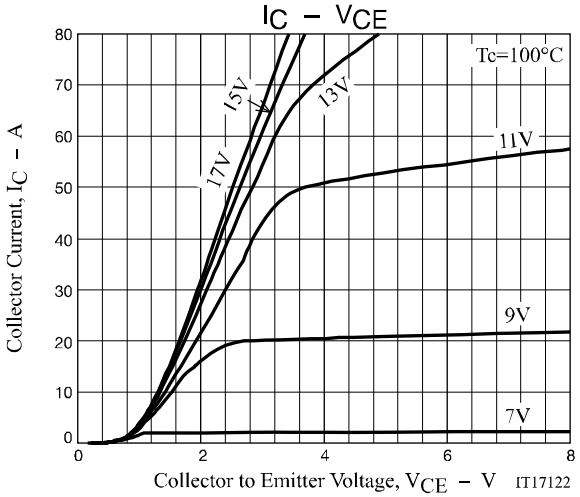
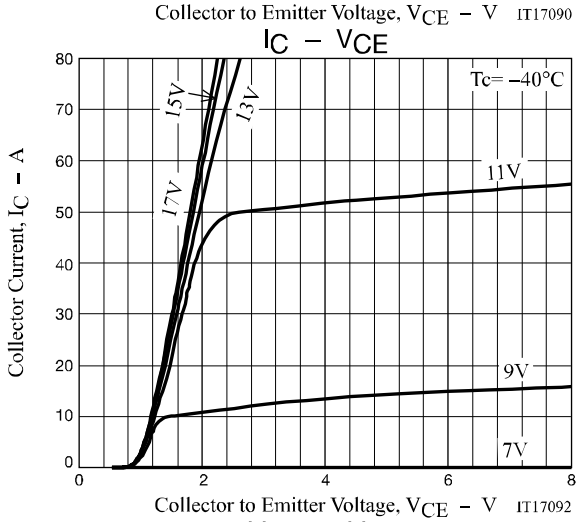


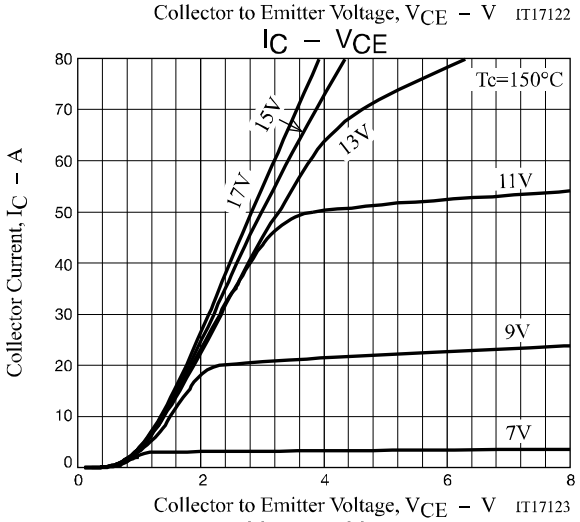
Fig.3 Reverse Recovery Time Test Circuit

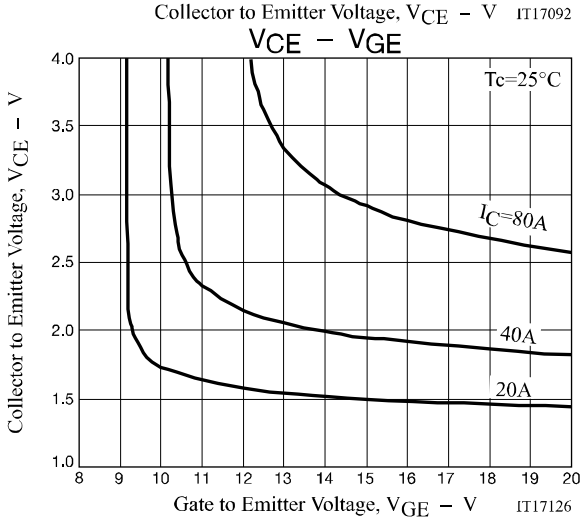


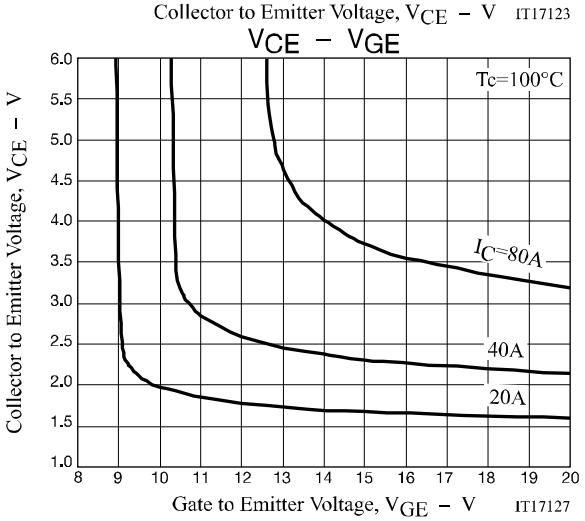

IC – VCE
Tc=25°C
17V
15V
13V
11V
9V
7V
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17090

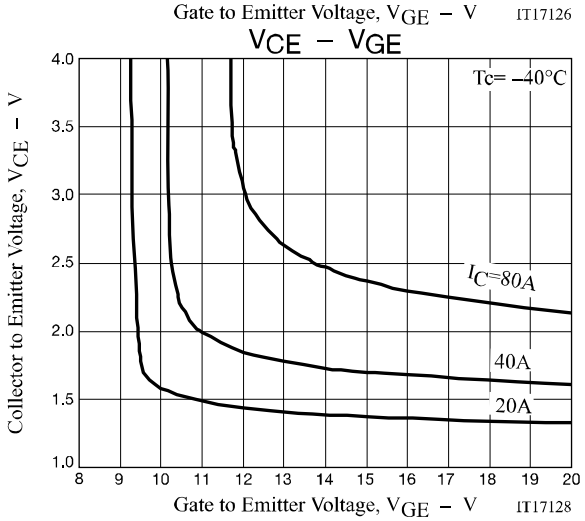

IC – VCE
Tc=100°C
17V
15V
13V
11V
9V
7V
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17122

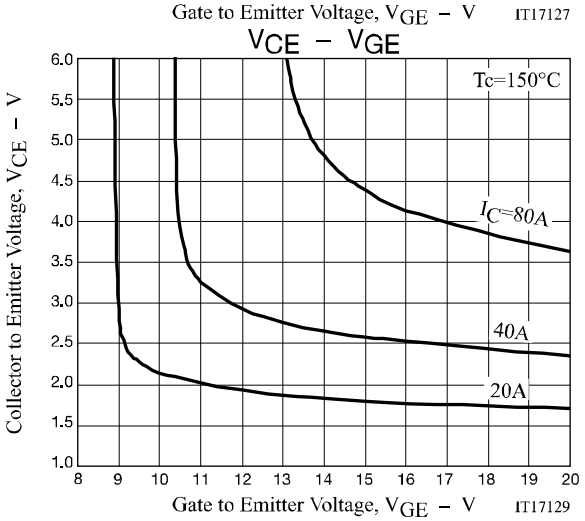

IC – VCE
Tc= –40°C
17V
15V
13V
11V
9V
7V
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17092

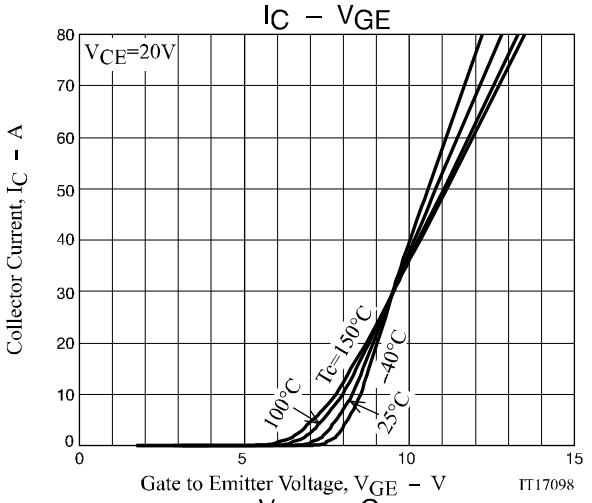

IC – VCE
Tc=150°C
17V
15V
13V
11V
9V
7V
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17123

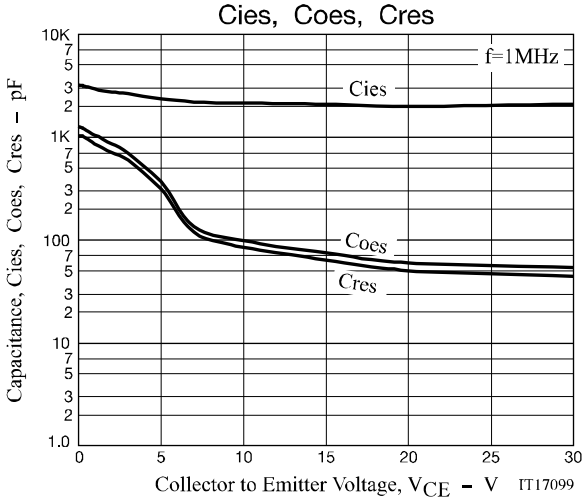

VCE – VGE
Tc=25°C
IC=80A
40A
20A
Collector to Emitter Voltage, VCE – V
Gate to Emitter Voltage, VGE – V
IT17126

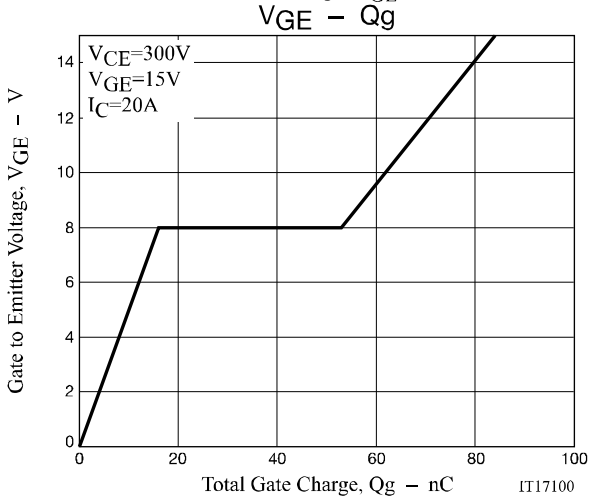

VCE – VGE
Tc=100°C
IC=80A
40A
20A
Collector to Emitter Voltage, VCE – V
Gate to Emitter Voltage, VGE – V
IT17127

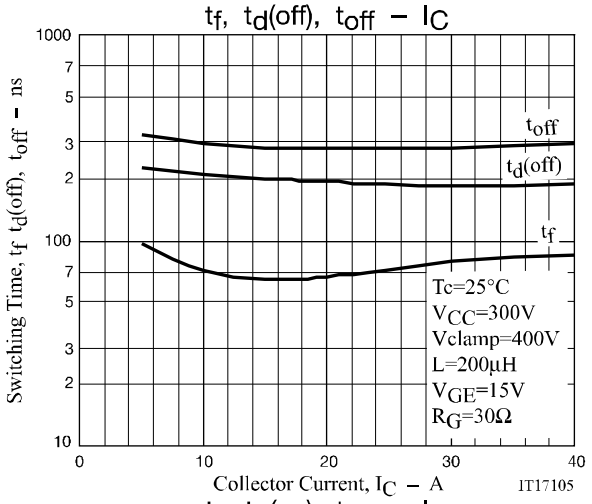

VCE – VGE
Tc= –40°C
IC=80A
40A
20A
Collector to Emitter Voltage, VCE – V
Gate to Emitter Voltage, VGE – V
IT17128

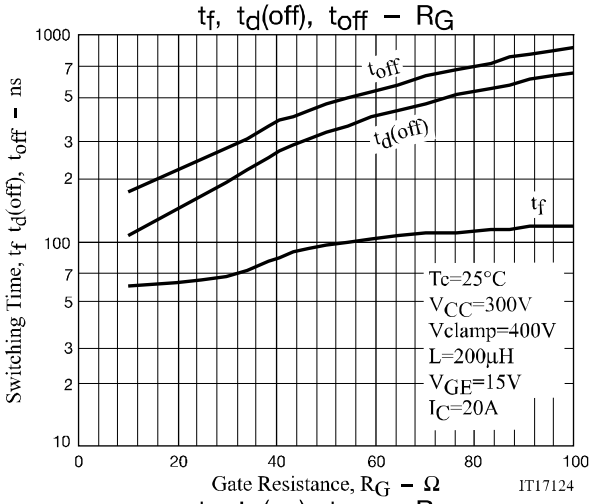

VCE – VGE
Tc=150°C
IC=80A
40A
20A
Collector to Emitter Voltage, VCE – V
Gate to Emitter Voltage, VGE – V
IT17129

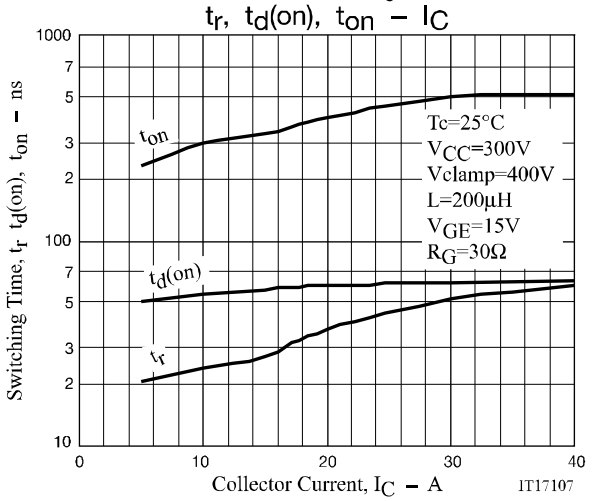

IC – VGE
VCE=20V
Tc=150°C
100°C
25°C
–40°C
Collector Current, IC – A
Gate to Emitter Voltage, VGE – V
IT17098

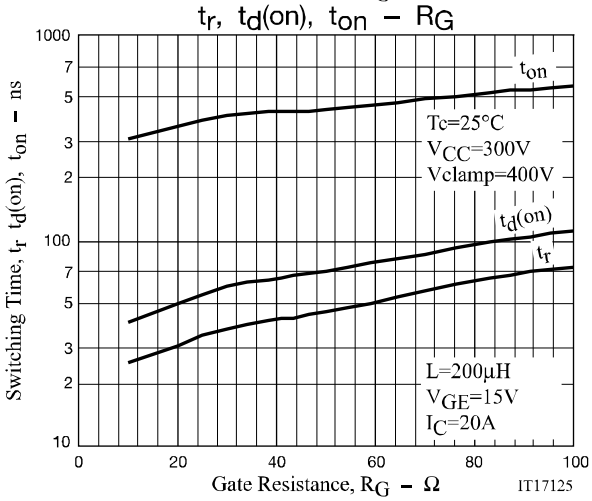

Cies, Coes, Cres
f=1MHz
Cies
Coes
Cres
Capacitance, Cies, Coes, Cres – pF
Collector to Emitter Voltage, VCE – V
IT17099


VGE – Qg
VCE=300V
VGE=15V
IC=20A
Gate to Emitter Voltage, VGE – V
Total Gate Charge, Qg – nC
IT17100

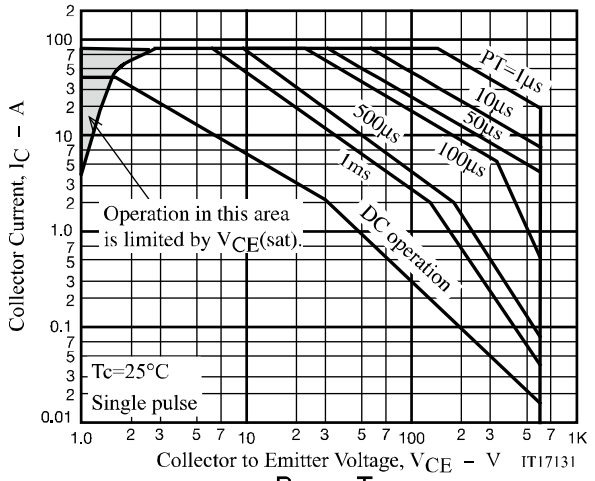

tf, td(off), toff – IC
toff
td(off)
tf
Tc=25°C
VCC=300V
Vclamp=400V
L=200µH
VGE=15V
RG=30Ω
Switching Time, tf, td(off), toff – ns
Collector Current, IC – A
IT17105


tf, td(off), toff – RG
toff
td(off)
tf
Tc=25°C
VCC=300V
Vclamp=400V
L=200µH
VGE=15V
IC=20A
Switching Time, tf, td(off), toff – ns
Gate Resistance, RG – Ω
IT17124

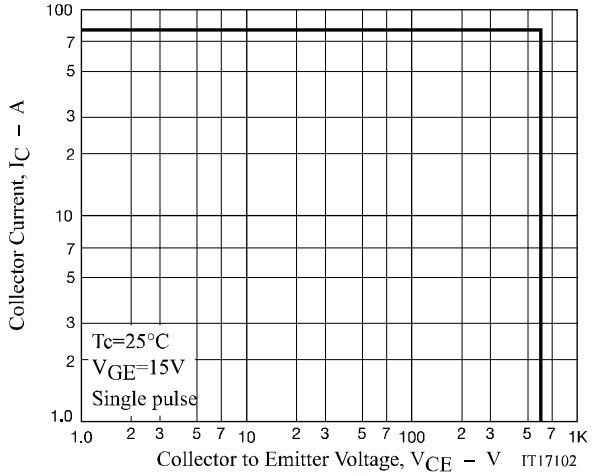

tr, td(on), ton – IC
ton
td(on)
tr
Tc=25°C
VCC=300V
Vclamp=400V
L=200µH
VGE=15V
RG=30Ω
Switching Time, tr, td(on), ton – ns
Collector Current, IC – A
IT17107


tr, td(on), ton – RG
ton
td(on)
tr
Tc=25°C
VCC=300V
Vclamp=400V
L=200µH
VGE=15V
IC=20A
Switching Time, tr, td(on), ton – ns
Gate Resistance, RG – Ω
IT17125

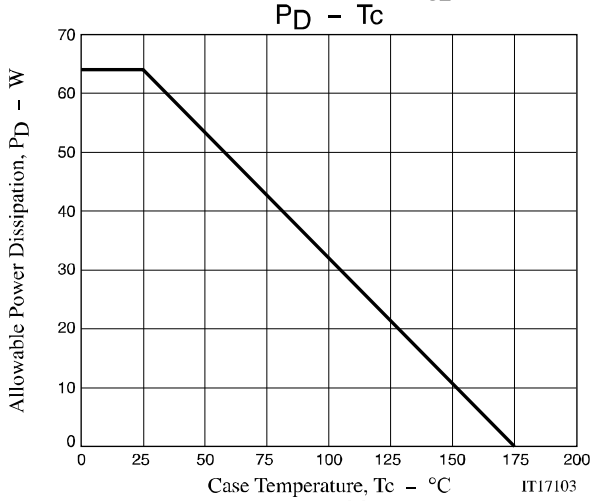
Forward Bias A S O



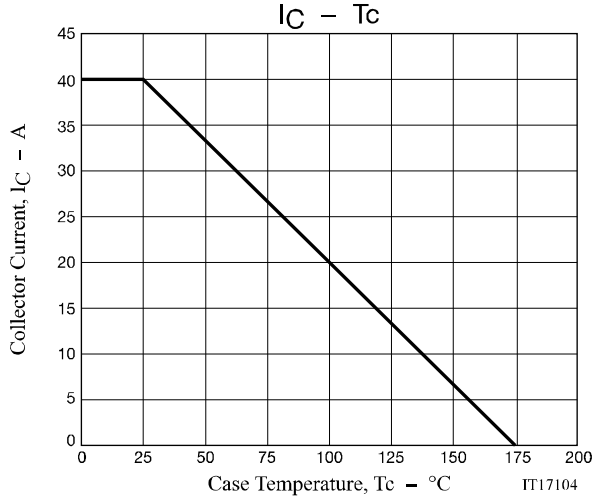
Reverse Bias A S O



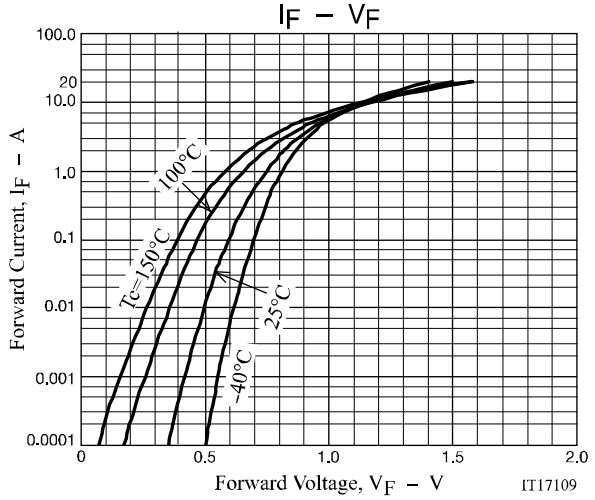
P_D – Tc



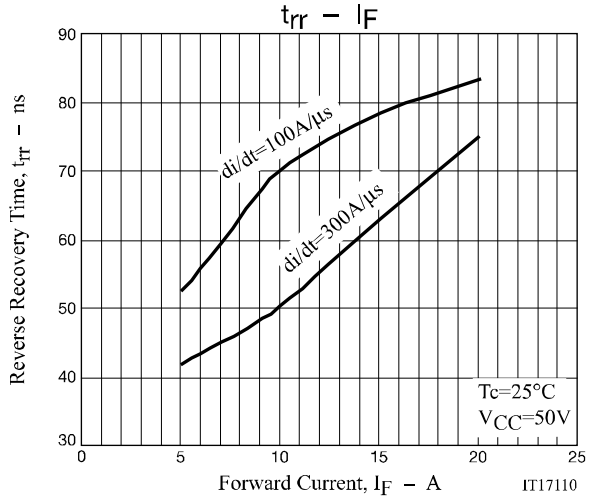
I_C – Tc



I_F – V_F

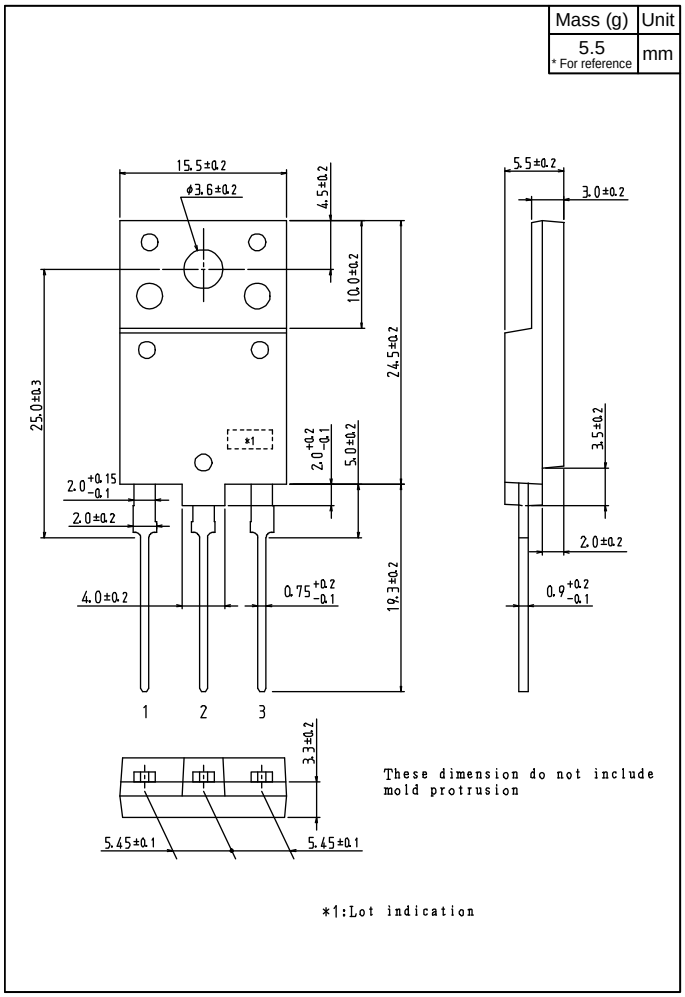


t_{rr} – I_F



Outline Drawing

NGTB20N60L2TF1G



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