NGTB10N60R2DT4G

IGBT
600V, 10A, N-Channel

ON Semiconductor®

www.onsemi.com

Features

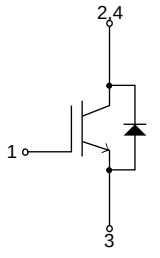
- Reverse Conducting Ⅱ IGBT
- IGBT V_{CE}(sat)=1.7V (typ) [I_C=10A, V_{GE}=15V]
- IGBT t_f=65ns (typ)
- Diode V_F=1.5V (typ) [I_F=10A]
- Diode t_{rr}=90ns (typ)
- 5μs Short Circuit Capability

Applications

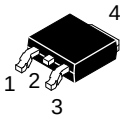
- General Purpose Inverter

Electrical Connection

N-Channel

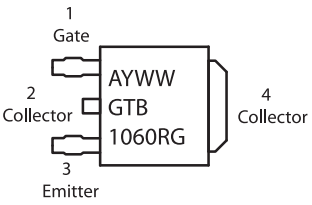


1:Gate
2:Collector
3:Emitter
4:Collector



DPAK
CASE 369C

Marking Diagram



GTB1060R	= Device Code
A	= Assembly Location
Y	= Year
WW	= Work Week
G	= Pb-Free Package

Specifications

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

Parameter		Symbol	Value	Unit
Collector to Emitter Voltage		V_{CES}	600	V
Gate to Emitter Voltage		V_{GES}	±20	V
Collector Current (DC)	@Tc=25°C *2	I_C *1	20	A
Limited by Tjmax	@Tc=100°C *2		10	A
Collector Current (Peak) Pulse width Llimited by Tjmax		I_{CP}	40	A
Diode Average Output Current		I_O	10	A
Power Dissipation Tc=25°C (Our ideal heat dissipation condition) *2		P_D	72	W
Junction Temperature		Tj	175	°C
Storage Temperature		Tstg	−55 to +175	°C

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

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

*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 aluminum.

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.

ORDERING INFORMATION
See detailed ordering and shipping information on page 7 of this data sheet.

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

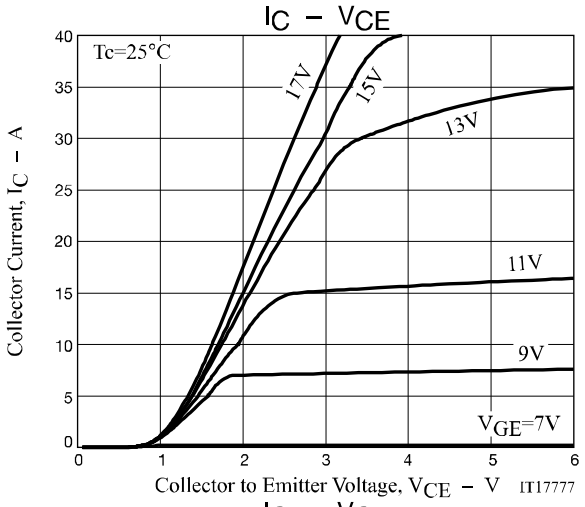
Parameter	Symbol	Conditions		Value			Unit
				min	typ	max	
Collector to Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C=1mA, V_{GE}=0V		600			V
Collector to Emitter Cut off Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	Tc=25°C			10	μA
			Tc=150°C			1	mA
Gate to Emitter Leakage Current	I_{GES}	V_{GE}=±20V, V_{CE}=0V				±100	nA
Gate to Emitter Threshold Voltage	V_{GE}(th)	V_{CE}=20V, I_C=160μA		4.5		7.0	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=10A	Tc=25°C		1.7	2.1	V
			Tc=100°C		1.9	2.3	V
Forward Diode Voltage	V_F	I_F=10A			1.5	2.1	V
Input Capacitance	Cies	V_{CE}=20V, f=1MHz			1340		pF
Output Capacitance	Coes				45		pF
Reverse Transfer Capacitance	Cres				33		pF
Turn-ON Delay Time	$t_{d(on)}$	V_{CC}=300V, I_C=10A R_G=30Ω, L=500μH V_{GE}=0V/15V Vclamp=400V Tc=25°C See Fig.1, See Fig.2			48		ns
Rise Time	t_r				34		ns
Turn-ON Time	ton				188		ns
Turn-OFF Delay Time	$t_{d(off)}$				120		ns
Fall Time	t_f				65		ns
Turn-OFF Time	toff				220		ns
Turn-ON Energy	Eon				412		μJ
Turn-OFF Energy	Eoff				140		μJ
Total Gate Charge	Qg	V_{CE}=300V, V_{GE}=15V, I_C=10A			53		nC
Gate to Emitter Charge	Qge				10		nC
Gate to Collector “Miller” Charge	Qgc				25		nC
Diode Reverse Recovery Time	t_{rr}	I_F=10A,di/dt=300A/μs, V_{CC}=300V, See Fig.3			90		ns

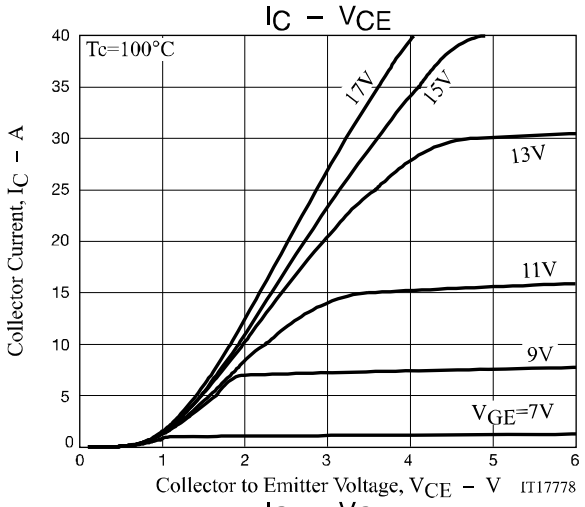
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

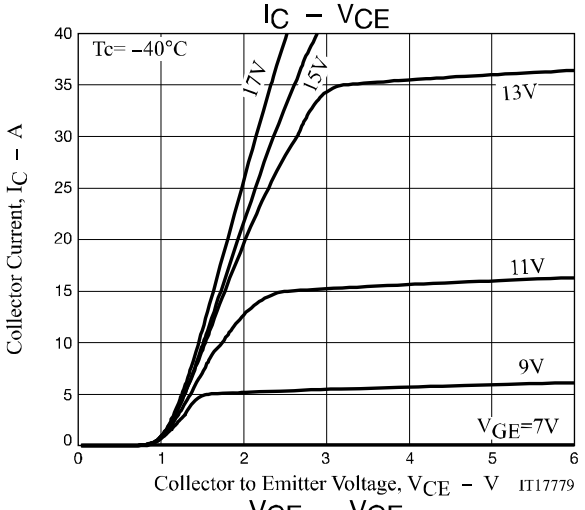
Thermal Characteristics at Ta=25°C, Unless otherwise specified

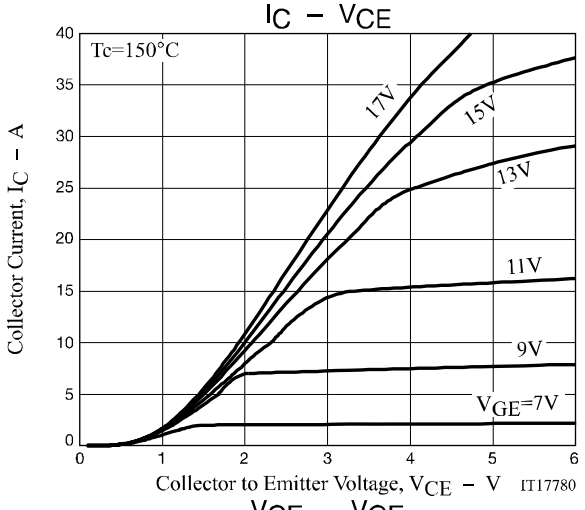
Parameter	Symbol	Conditions	Value	Unit
Thermal Resistance IGBT (Junction to Case)	Rth(j-c) (IGBT)	Tc=25°C (Our ideal heat dissipation condition) *2	2.07	°C/W
Thermal Resistance (Junction to Ambient)	Rth(j-a)		100	°C/W

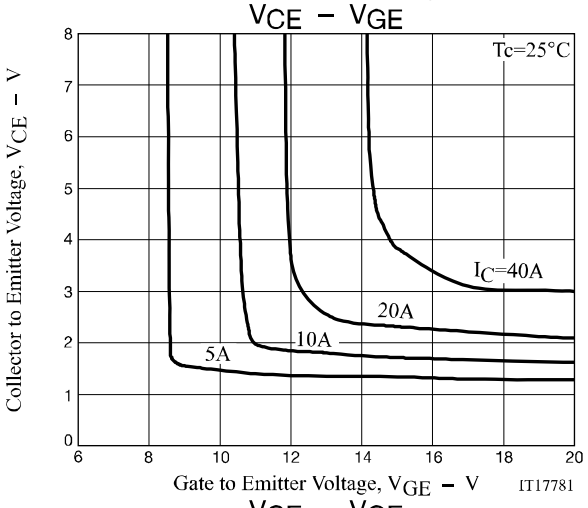
Note : *2 Our condition is radiation from backside.
The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

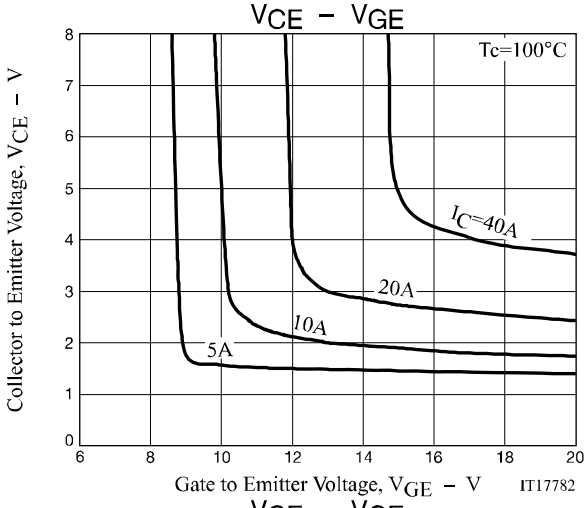

IC − VCE
Tc=25°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17777

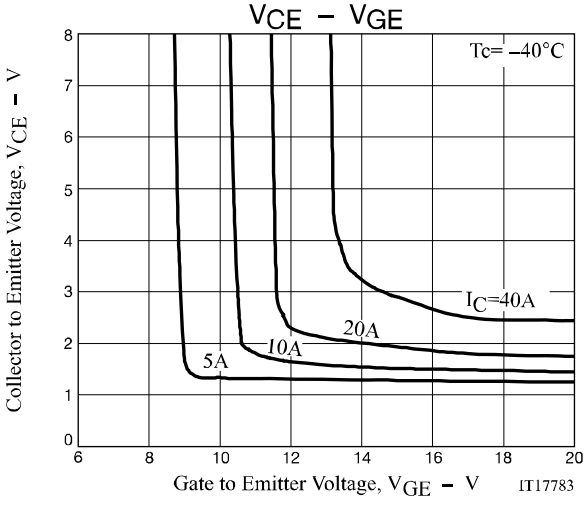

IC − VCE
Tc=100°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17778

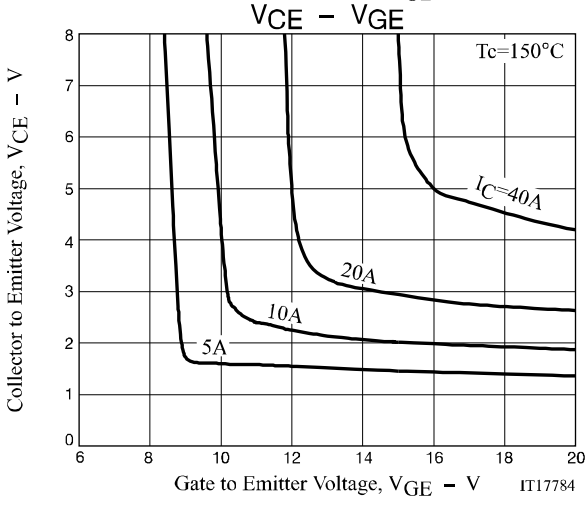

IC − VCE
Tc= −40°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17779

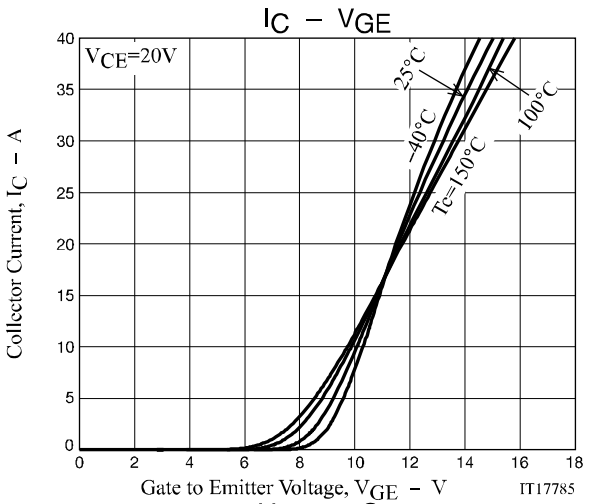

IC − VCE
Tc=150°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17780

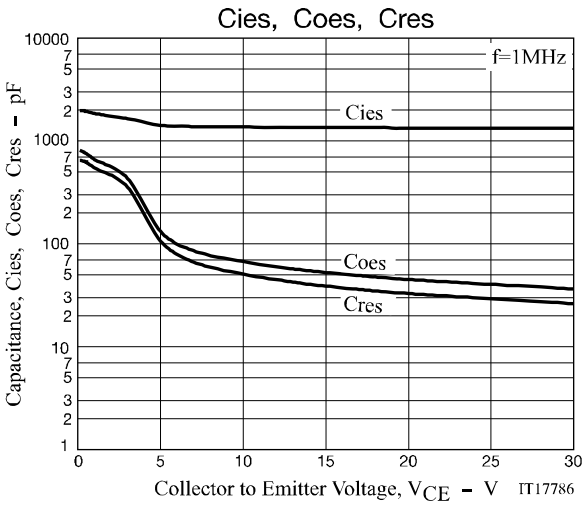

VCE − VGE
Tc=25°C
IC=40A
20A
10A
5A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17781

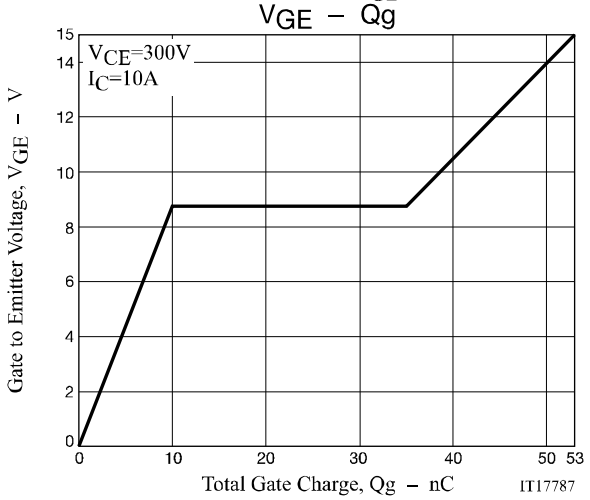

VCE − VGE
Tc=100°C
IC=40A
20A
10A
5A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17782

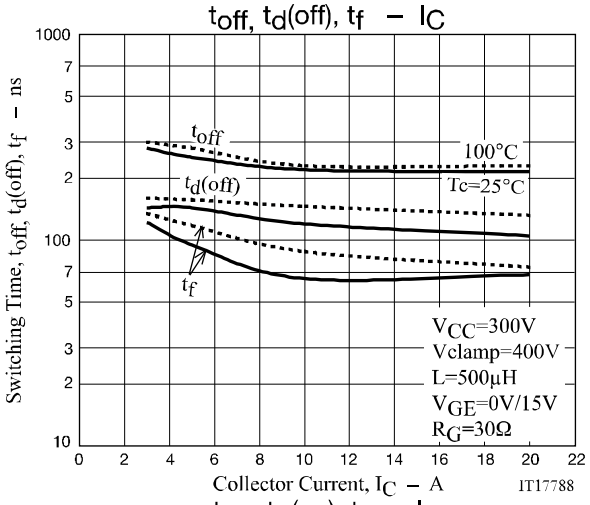

VCE − VGE
Tc= −40°C
IC=40A
20A
10A
5A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17783

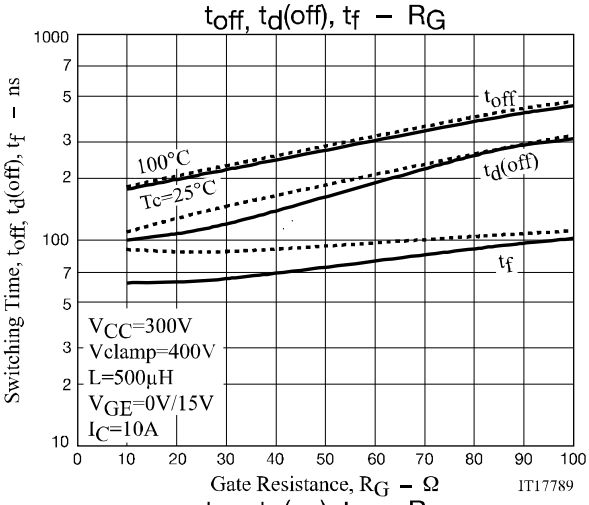

VCE − VGE
Tc=150°C
IC=40A
20A
10A
5A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17784

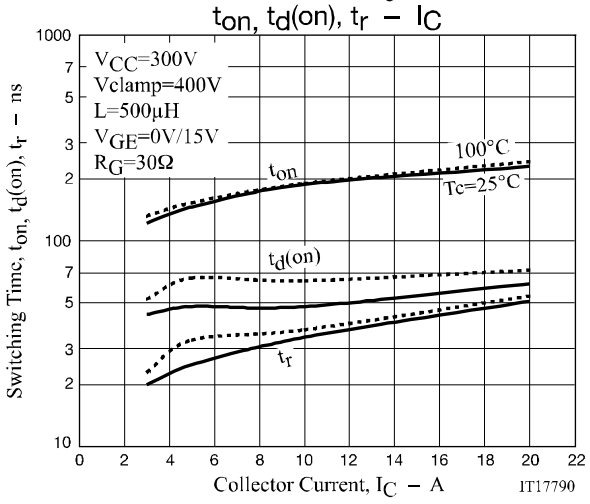

I_C – V_{GE}
V_{CE}=20V
25°C
–40°C
100°C
Tc=150°C
Collector Current, I_C – A
Gate to Emitter Voltage, V_{GE} – V
IT17785

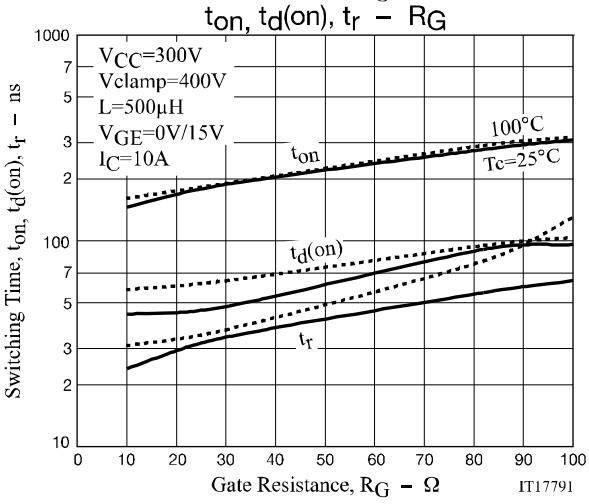

Cies, Coes, Cres
f=1MHz
Cies
Coes
Cres
Capacitance, Cies, Coes, Cres – pF
Collector to Emitter Voltage, V_{CE} – V
IT17786

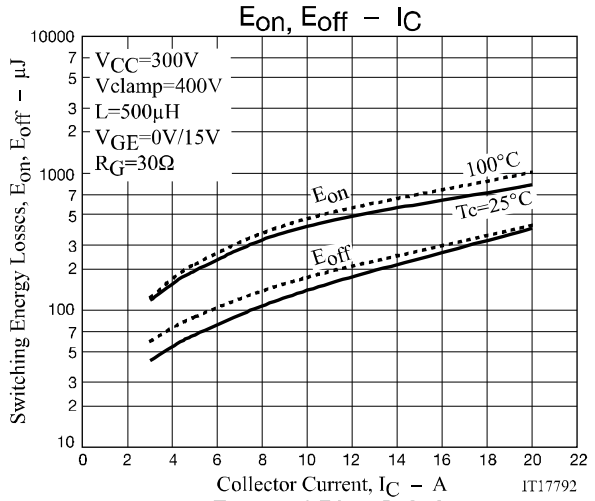

V_{GE} – Qg
V_{CE}=300V
I_C=10A
Gate to Emitter Voltage, V_{GE} – V
Total Gate Charge, Qg – nC
IT17787

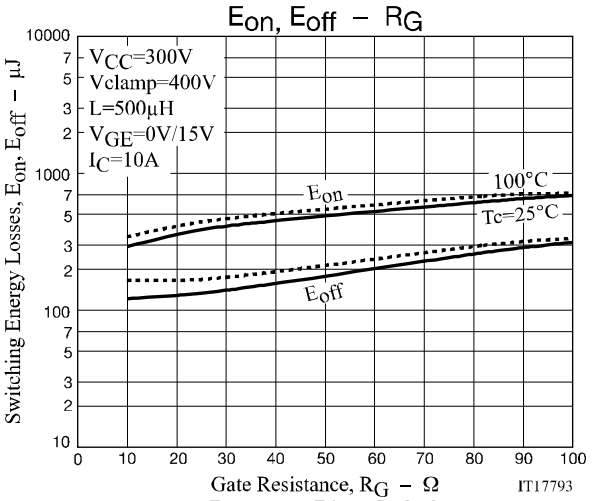

t_{off}, $t_{d(off)}$, t_f – I_C
t_{off}
$t_{d(off)}$
t_f
100°C
Tc=25°C
V_{CC}=300V
Vclamp=400V
L=500µH
V_{GE}=0V/15V
R_G=30Ω
Switching Time, t_{off}, $t_{d(off)}$, t_f – ns
Collector Current, I_C – A
IT17788

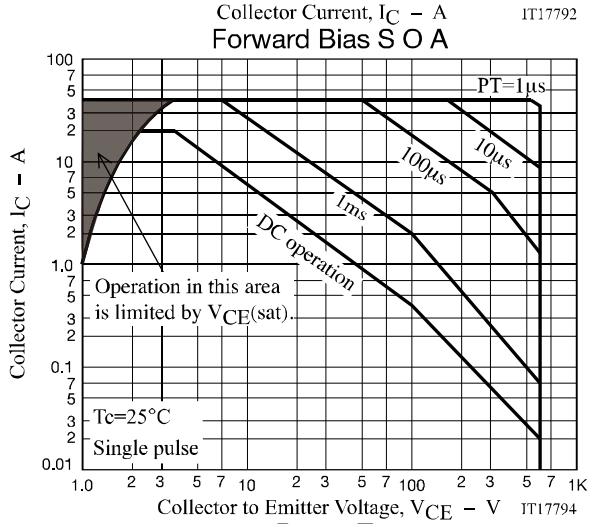

t_{off}, $t_{d(off)}$, t_f – R_G
t_{off}
$t_{d(off)}$
t_f
100°C
Tc=25°C
V_{CC}=300V
Vclamp=400V
L=500µH
V_{GE}=0V/15V
I_C=10A
Switching Time, t_{off}, $t_{d(off)}$, t_f – ns
Gate Resistance, R_G – Ω
IT17789

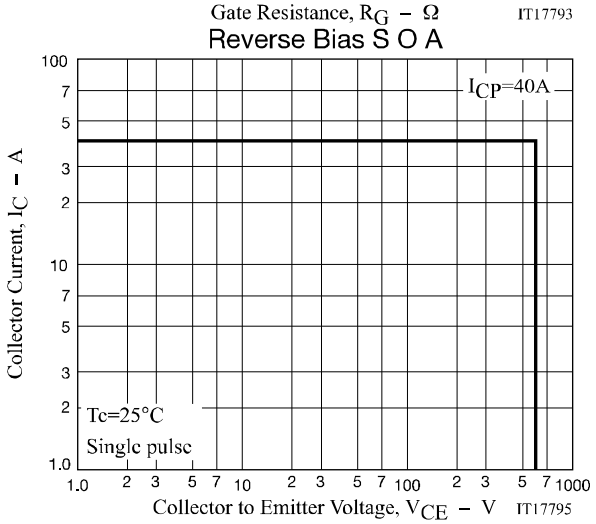

t_{on}, $t_{d(on)}$, t_r – I_C
V_{CC}=300V
Vclamp=400V
L=500µH
V_{GE}=0V/15V
R_G=30Ω
t_{on}
$t_{d(on)}$
t_r
100°C
Tc=25°C
Switching Time, t_{on}, $t_{d(on)}$, t_r – ns
Collector Current, I_C – A
IT17790

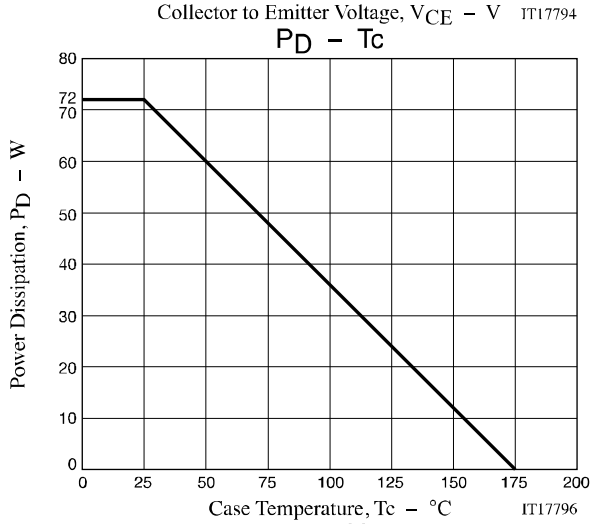

t_{on}, $t_{d(on)}$, t_r – R_G
V_{CC}=300V
Vclamp=400V
L=500µH
V_{GE}=0V/15V
I_C=10A
t_{on}
$t_{d(on)}$
t_r
100°C
Tc=25°C
Switching Time, t_{on}, $t_{d(on)}$, t_r – ns
Gate Resistance, R_G – Ω
IT17791

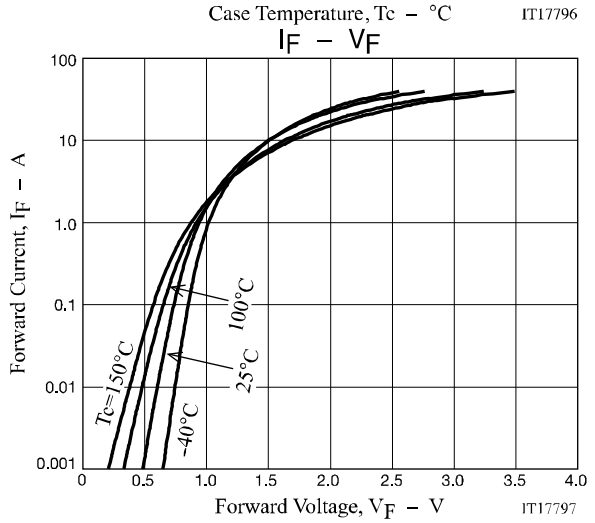

Eon, Eoff – IC
VCC=300V
Vclamp=400V
L=500μH
VGE=0V/15V
RG=30Ω
Eon
Eoff
100°C
Tc=25°C
Switching Energy Losses, Eon, Eoff – μJ
Collector Current, IC – A
IT17792

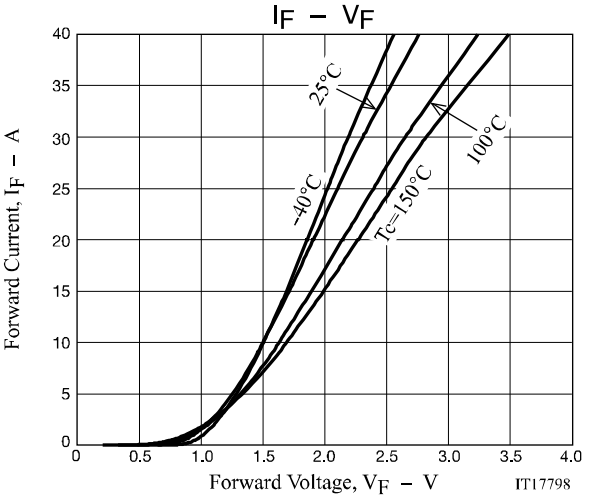

Eon, Eoff – RG
VCC=300V
Vclamp=400V
L=500μH
VGE=0V/15V
IC=10A
Eon
Eoff
100°C
Tc=25°C
Switching Energy Losses, Eon, Eoff – μJ
Gate Resistance, RG – Ω
IT17793

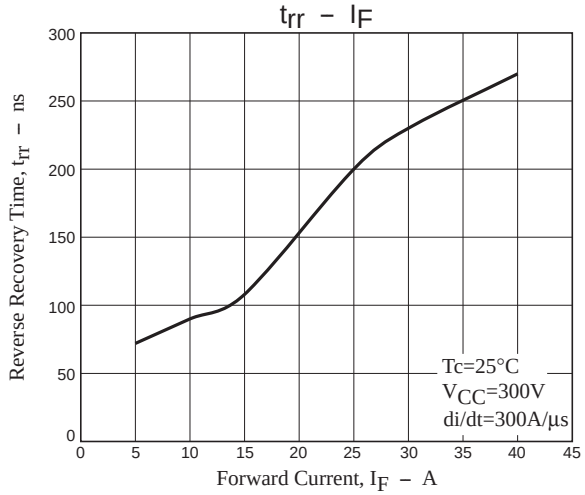

Forward Bias S O A
PT=1μs
100μs
10μs
1ms
DC operation
Operation in this area
is limited by VCE(sat).
Tc=25°C
Single pulse
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17794


Reverse Bias S O A
ICP=40A
Tc=25°C
Single pulse
Collector Current, IC – A
Collector to Emitter Voltage, VCE – V
IT17795


PD – Tc
Power Dissipation, PD – W
Case Temperature, Tc – °C
IT17796


IF – VF
Tc=150°C
100°C
25°C
-40°C
Forward Current, IF – A
Forward Voltage, VF – V
IT17797


IF – VF
25°C
-40°C
Tc=150°C
100°C
Forward Current, IF – A
Forward Voltage, VF – V
IT17798



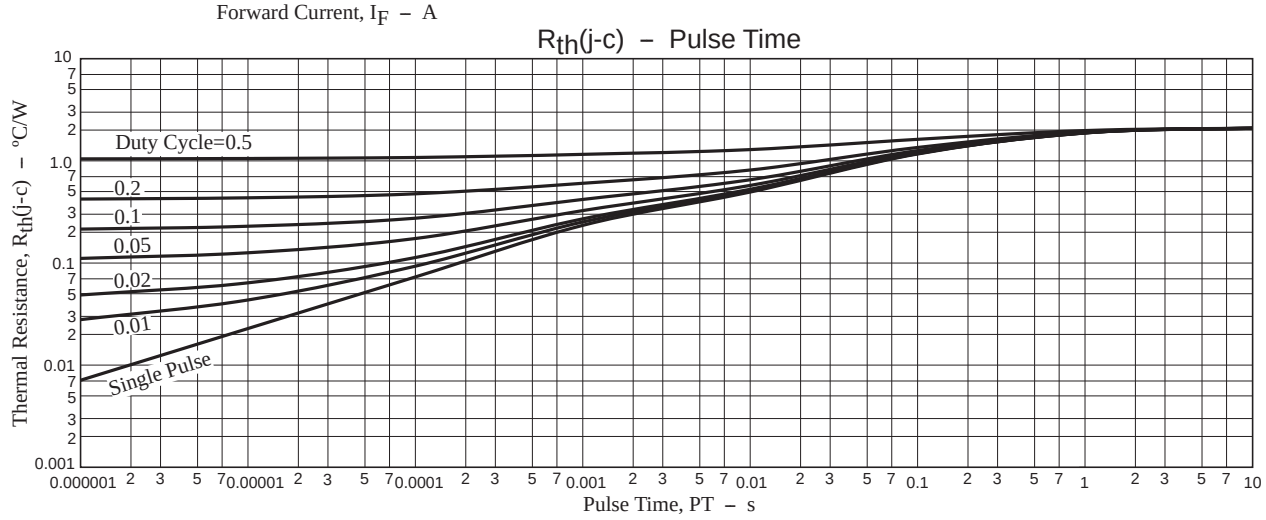


Fig.1 Switching Time Test Circuit

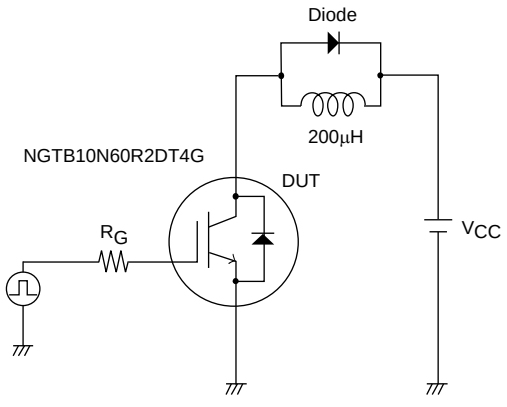


Fig.2 Timing Chart

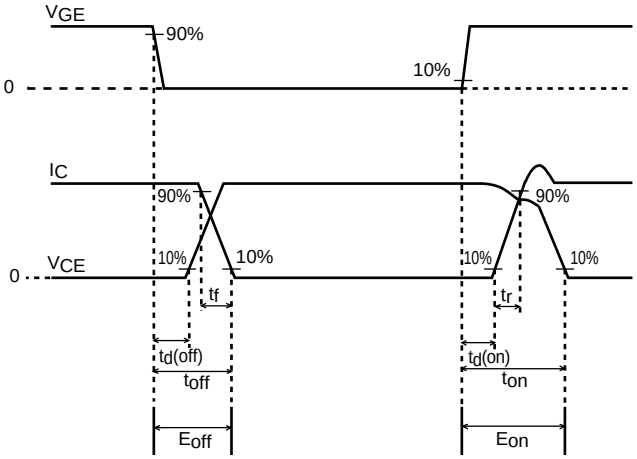
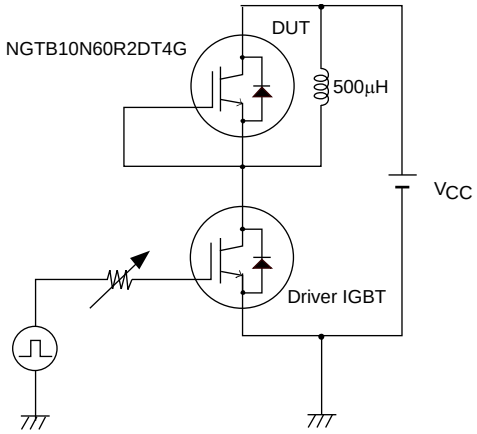


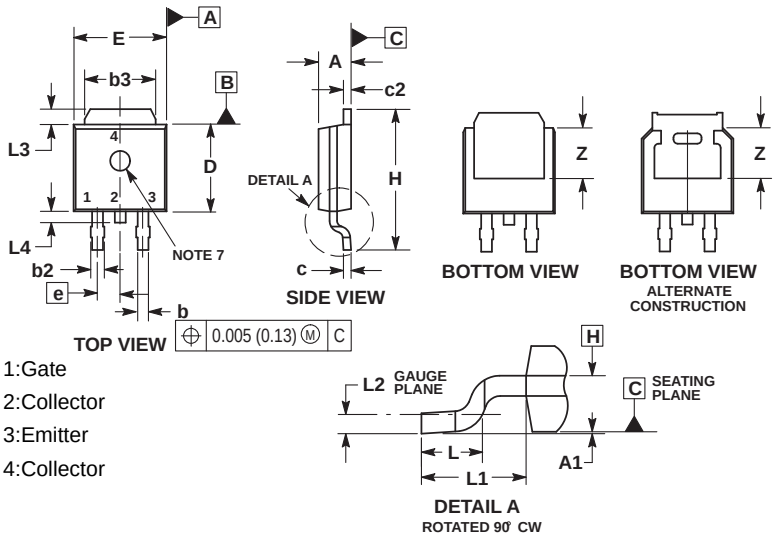
Fig.3 Reverse Recovery Time Test Circuit



Package Dimensions

unit : mm

DPAK (SINGLE GAUGE)
CASE 369C
ISSUE E



1:Gate
2:Collector
3:Emitter
4:Collector

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.028	0.045	0.72	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.114 REF		2.90 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---	0.040	---	1.01
Z	0.155	---	3.93	---

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

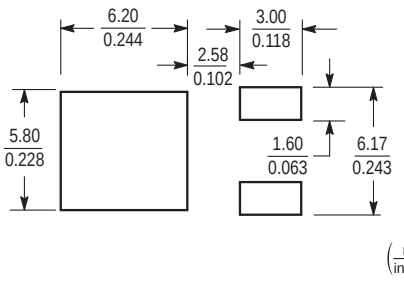
STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE

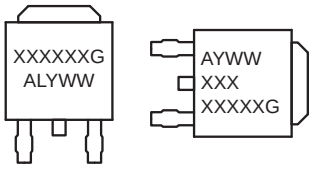
STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



IC Discrete

XXXXXX = Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

ORDERING INFORMATION

Device	Package	Shipping	note
NGTB10N60R2DT4G	DPAK	2500 pcs. / reel	Pb-Free And Halogen Free

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