NGTB03N60R2DT4G

IGBT
600V, 4.5A, N-Channel

ON Semiconductor®

www.onsemi.com

Features

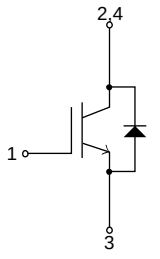
- Reverse Conducting Ⅱ IGBT
- IGBT V_{CE}(sat)=1.7V (typ) [I_C=3A, V_{GE}=15V]
- IGBT t_f=75ns (typ)
- Diode V_F=1.5V (typ) [I_F=3A]
- Diode t_{rr}=65ns (typ)
- 5μs Short Circuit Capability

Applications

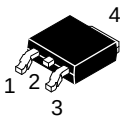
- General Purpose Inverter

Electrical Connection

N-Channel



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



DPAK
CASE 369C

Specifications

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

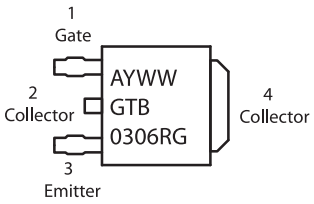
Parameter		Symbol	Value	Unit
Collector to Emitter Voltage		V_{CES}	600	V
Gate to Emitter Voltage		V_{GES}	±20	V
Collector Current (DC)	@Tc=25°C *2	I_C *1	9	A
Limited by Tjmax	@Tc=100°C *2		4.5	A
Collector Current (Peak) Pulse width Llimited by Tjmax		I_{CP}	12	A
Diode Average Output Current		I_O	4.5	A
Power Dissipation Tc=25°C (Our ideal heat dissipation condition) *2		P_D	49	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.

Marking Diagram



GTB0306R	= Device Code
A	= Assembly Location
Y	= Year
WW	= Work Week
G	= Pb-Free Package

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

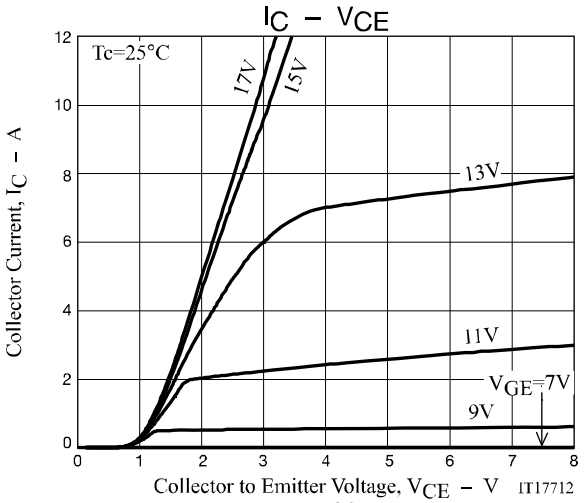
Parameter	Symbol	Conditions		Value			Unit
				min	typ	max	
Collector to Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C=1mA, V_{GE}=0V		600			V
Collector to Emitter Cut off Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	Tc=25°C			10	μA
			Tc=150°C			1	mA
Gate to Emitter Leakage Current	I_{GES}	V_{GE}=±20V, V_{CE}=0V				±100	nA
Gate to Emitter Threshold Voltage	V_{GE}(th)	V_{CE}=20V, I_C=80μA		4.5		7.0	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=3A	Tc=25°C		1.7	2.1	V
			Tc=100°C		1.9	2.3	V
Forward Diode Voltage	V_F	I_F=3A			1.5	2.1	V
Input Capacitance	Cies	V_{CE}=20V, f=1MHz			415		pF
Output Capacitance	Coes				17		pF
Reverse Transfer Capacitance	Cres				10		pF
Turn-ON Delay Time	$t_{d(on)}$	V_{CC}=300V, I_C=3A R_G=30Ω, L=500μH V_{GE}=0V/15V Vclamp=400V Tc=25°C See Fig.1, See Fig.2			27		ns
Rise Time	t_r				17		ns
Turn-ON Time	ton				85		ns
Turn-OFF Delay Time	$t_{d(off)}$				59		ns
Fall Time	t_f				75		ns
Turn-OFF Time	toff				172		ns
Turn-ON Energy	Eon				50		μJ
Turn-OFF Energy	Eoff				27		μJ
Total Gate Charge	Qg	V_{CE}=300V, V_{GE}=15V, I_C=3A			17		nC
Gate to Emitter Charge	Qge				4.4		nC
Gate to Collector “Miller” Charge	Qgc				7.6		nC
Diode Reverse Recovery Time	t_{rr}	I_F=3A,di/dt=200A/μs, V_{CC}=300V, See Fig.3			65		ns

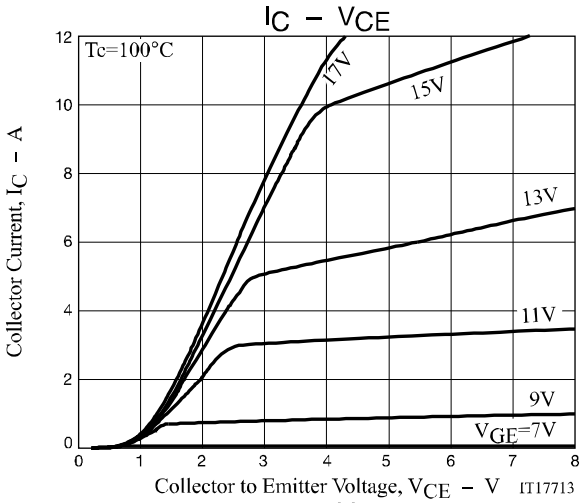
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

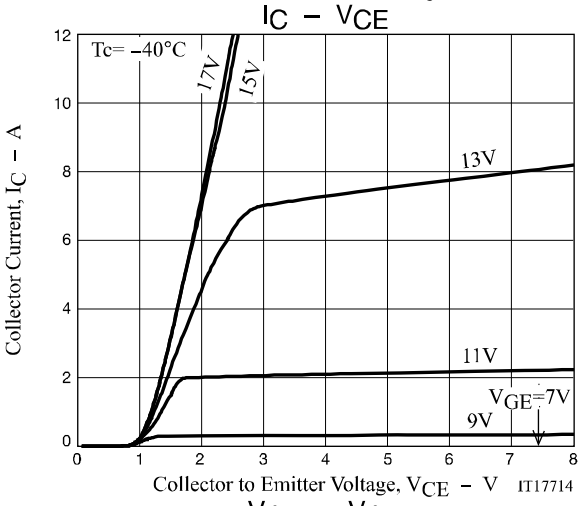
Thermal Characteristics at Ta=25°C, Unless otherwise specified

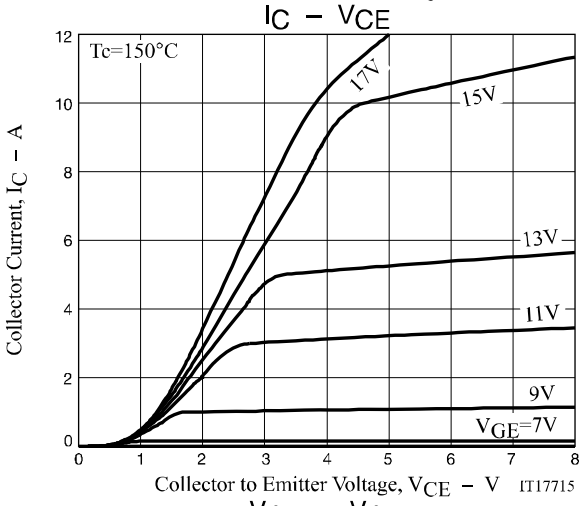
Parameter	Symbol	Conditions	Value	Unit
Thermal Resistance IGBT (Junction to Case)	Rth(j-c) (IGBT)	Tc=25°C (Our ideal heat dissipation condition) *2	3.06	°C/W
Thermal Resistance (Junction to Ambient)	Rth(j-a)		100	°C/W

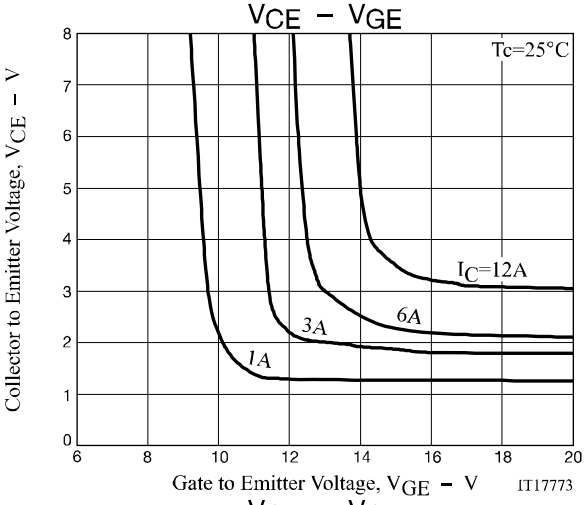
Note : *2 Our condition is radiation from backside.
The method is applying silicone grease to the backside of the device and attaching the device to water-cooled radiator made of aluminum.

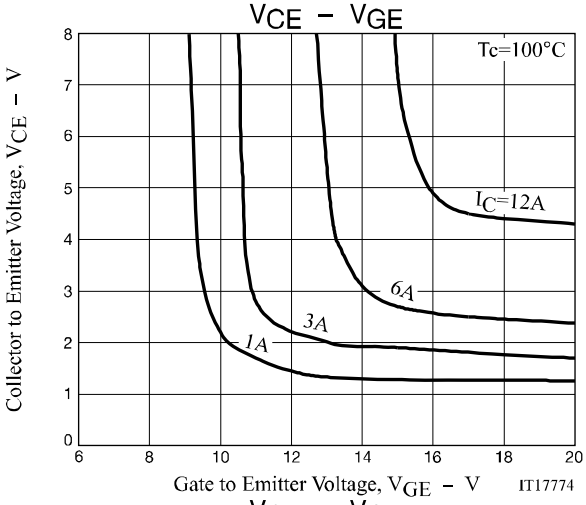

IC − VCE
Tc=25°C
17V
15V
13V
11V
VGE=7V
9V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17712

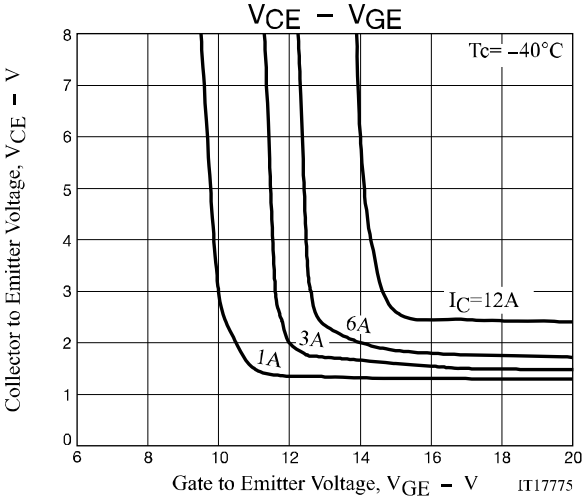

IC − VCE
Tc=100°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17713

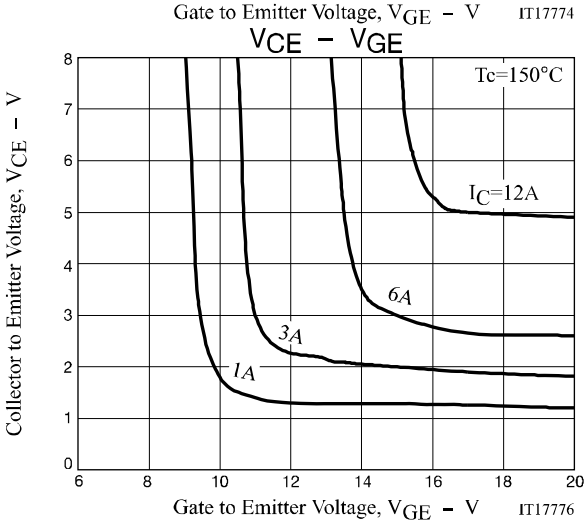

IC − VCE
Tc= −40°C
17V
15V
13V
11V
VGE=7V
9V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17714

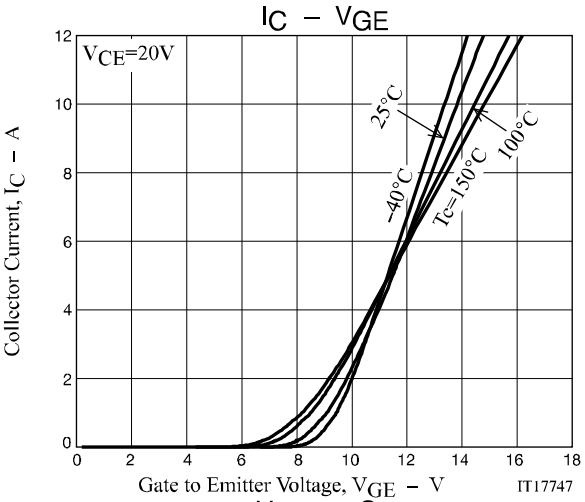

IC − VCE
Tc=150°C
17V
15V
13V
11V
9V
VGE=7V
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17715

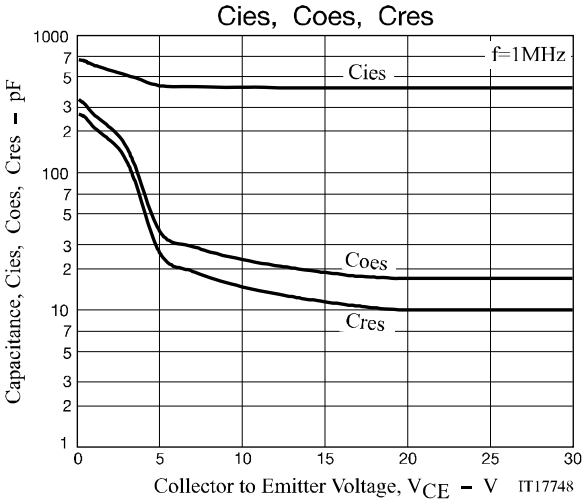

VCE − VGE
Tc=25°C
IC=12A
6A
3A
1A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17773

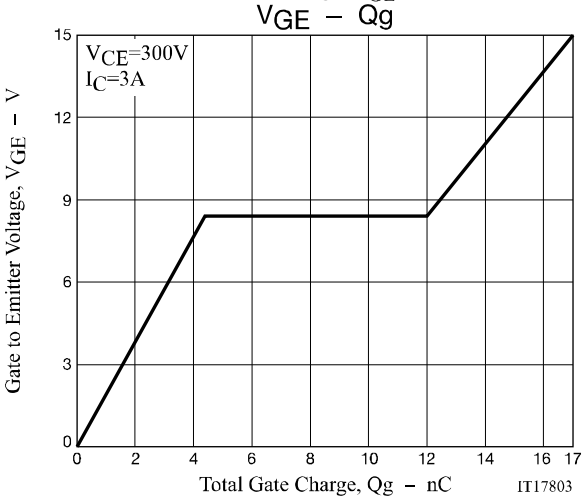

VCE − VGE
Tc=100°C
IC=12A
6A
3A
1A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17774

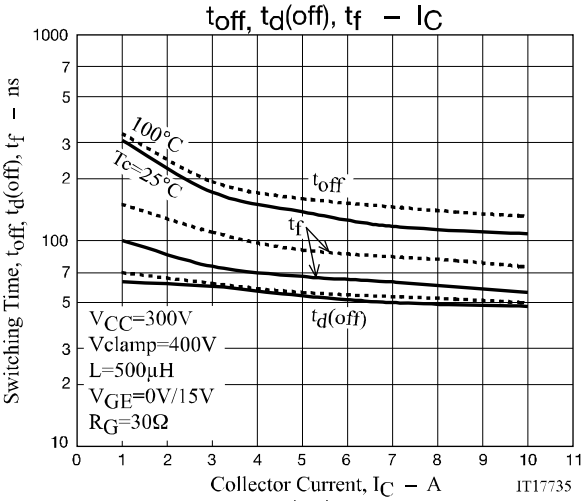

VCE − VGE
Tc= −40°C
IC=12A
6A
3A
1A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17775

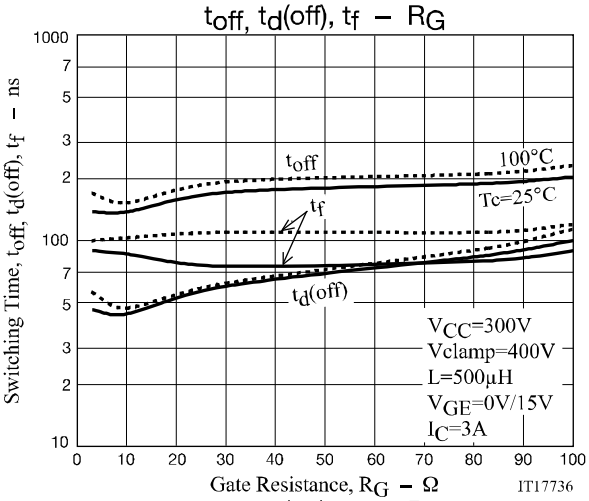

VCE − VGE
Tc=150°C
IC=12A
6A
3A
1A
Collector to Emitter Voltage, VCE − V
Gate to Emitter Voltage, VGE − V
IT17776

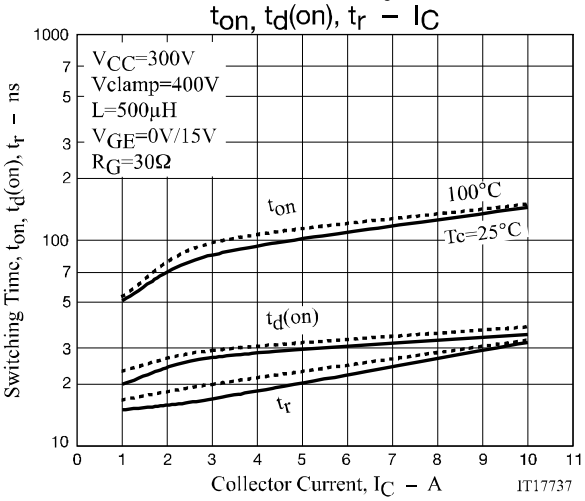

IC – VGE
VCE=20V
25°C
–40°C
Tc=150°C
100°C
Collector Current, IC – A
Gate to Emitter Voltage, VGE – V
IT17747

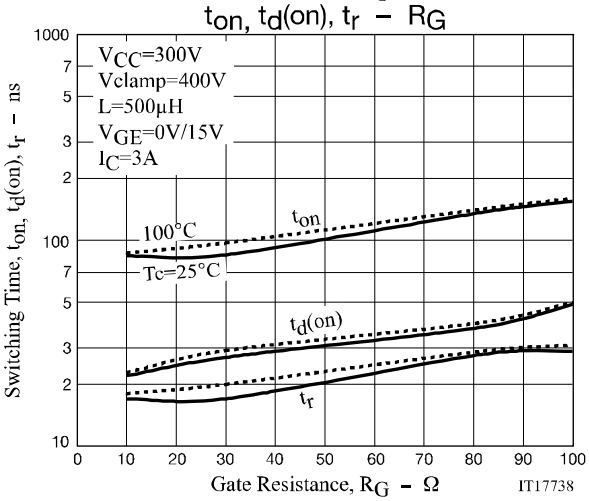

Cies, Coes, Cres
f=1MHz
Cies
Coes
Cres
Capacitance, Cies, Coes, Cres – pF
Collector to Emitter Voltage, VCE – V
IT17748

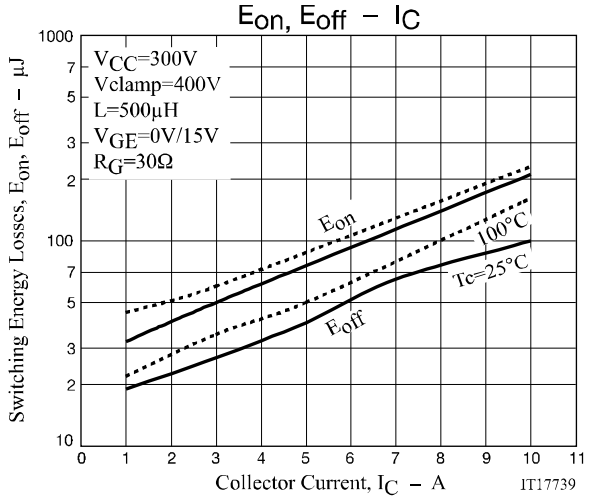

VGE – Qg
VCE=300V
IC=3A
Gate to Emitter Voltage, VGE – V
Total Gate Charge, Qg – nC
IT17803

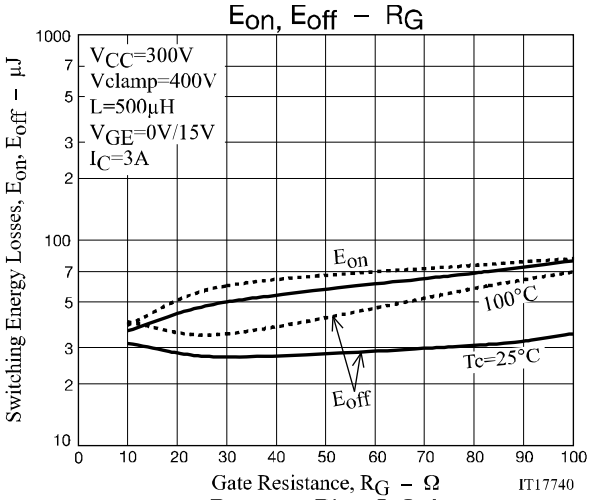

toff, td(off), tf – IC
100°C
Tc=25°C
toff
tf
td(off)
VCC=300V
Vclamp=400V
L=500µH
VGE=0V/15V
RG=30Ω
Switching Time, toff, td(off), tf – ns
Collector Current, IC – A
IT17735

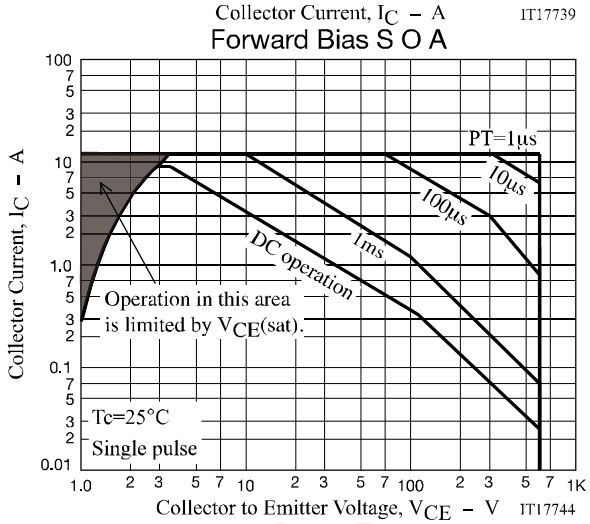

toff, td(off), tf – RG
toff
100°C
Tc=25°C
tf
td(off)
VCC=300V
Vclamp=400V
L=500µH
VGE=0V/15V
IC=3A
Switching Time, toff, td(off), tf – ns
Gate Resistance, RG – Ω
IT17736

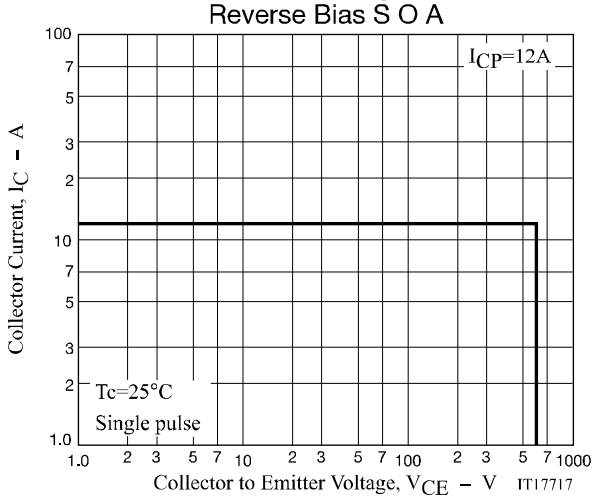

ton, td(on), tr – IC
VCC=300V
Vclamp=400V
L=500µH
VGE=0V/15V
RG=30Ω
ton
100°C
Tc=25°C
td(on)
tr
Switching Time, ton, td(on), tr – ns
Collector Current, IC – A
IT17737

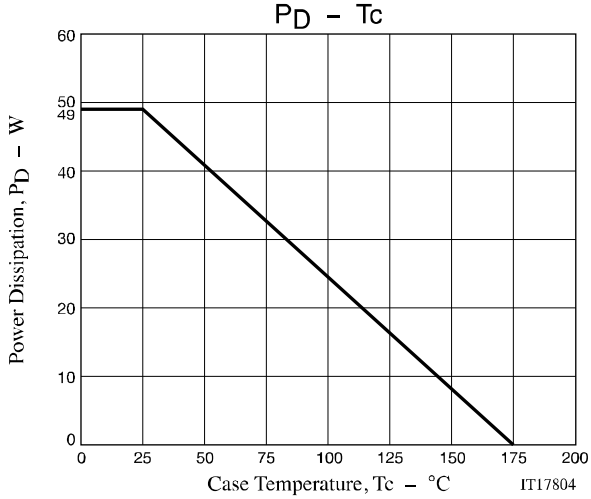

ton, td(on), tr – RG
VCC=300V
Vclamp=400V
L=500µH
VGE=0V/15V
IC=3A
100°C
ton
Tc=25°C
td(on)
tr
Switching Time, ton, td(on), tr – ns
Gate Resistance, RG – Ω
IT17738

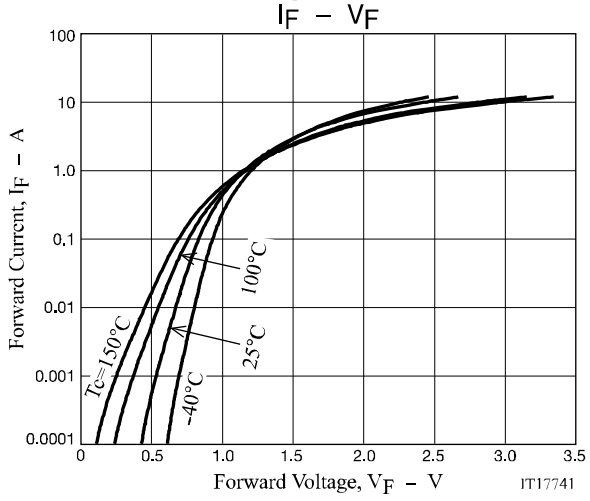

Eon, Eoff − IC
VCC=300V
Vclamp=400V
L=500μH
VGE=0V/15V
RG=30Ω
Eon
100°C
Tc=25°C
Eoff
Switching Energy Losses, Eon, Eoff − μJ
Collector Current, IC − A
IT17739

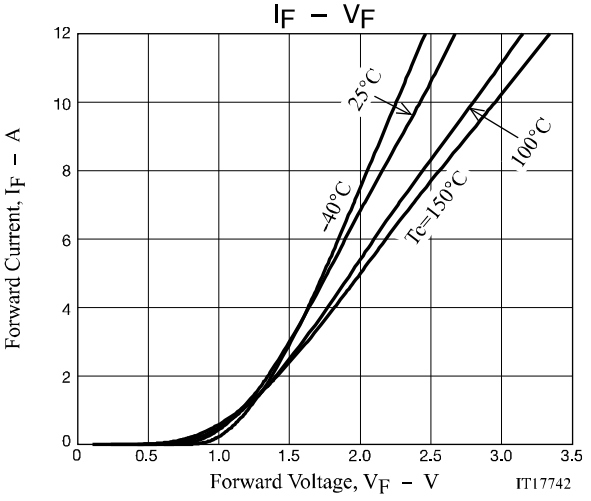

Eon, Eoff − RG
VCC=300V
Vclamp=400V
L=500μH
VGE=0V/15V
IC=3A
Eon
100°C
Tc=25°C
Eoff
Switching Energy Losses, Eon, Eoff − μJ
Gate Resistance, RG − Ω
IT17740

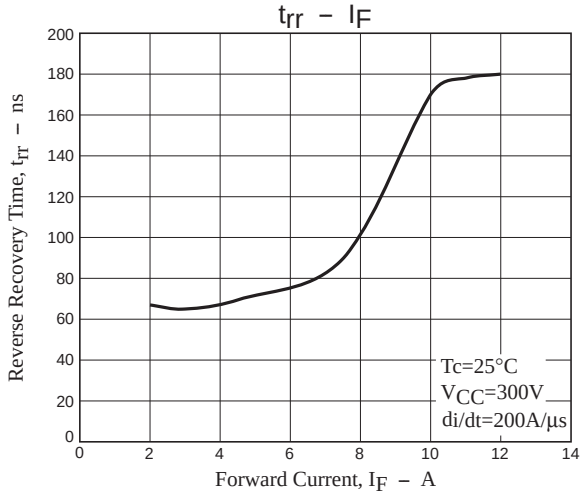

Forward Bias S O A
PT=1μs
10μs
100μs
1ms
DC operation
Operation in this area
is limited by VCE(sat).
Tc=25°C
Single pulse
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17744


Reverse Bias S O A
ICP=12A
Tc=25°C
Single pulse
Collector Current, IC − A
Collector to Emitter Voltage, VCE − V
IT17717


PD − Tc
Power Dissipation, PD − W
Case Temperature, Tc − °C
IT17804


IF − VF
Tc=150°C
100°C
25°C
-40°C
Forward Current, IF − A
Forward Voltage, VF − V
IT17741


IF − VF
25°C
100°C
-40°C
Tc=150°C
Forward Current, IF − A
Forward Voltage, VF − V
IT17742



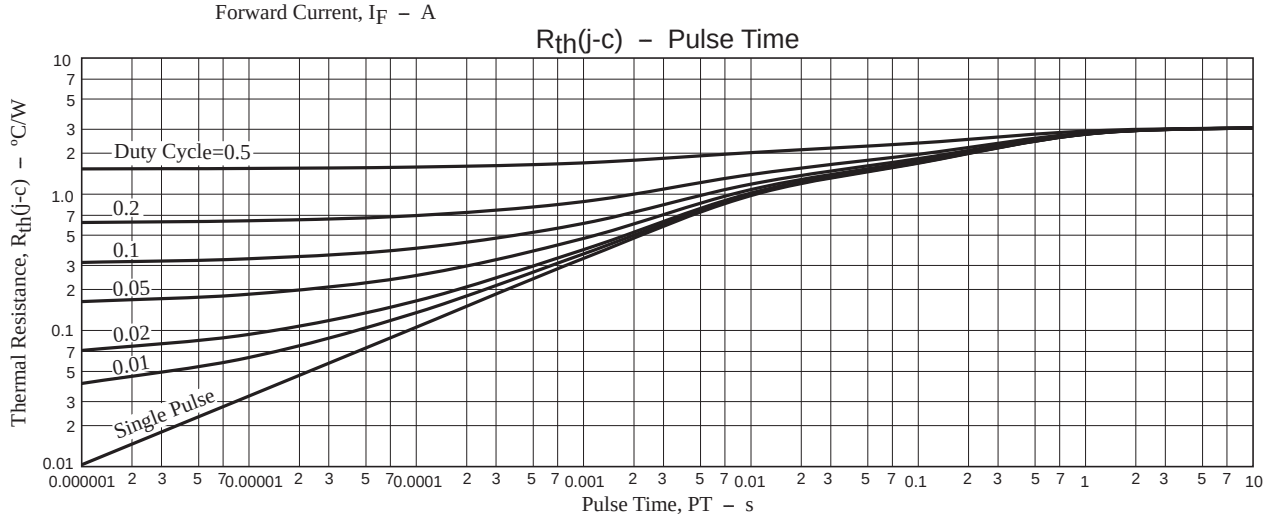


Fig.1 Switching Time Test Circuit

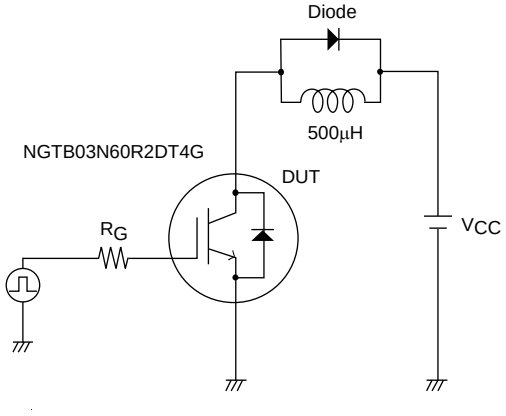


Fig.2 Timing Chart

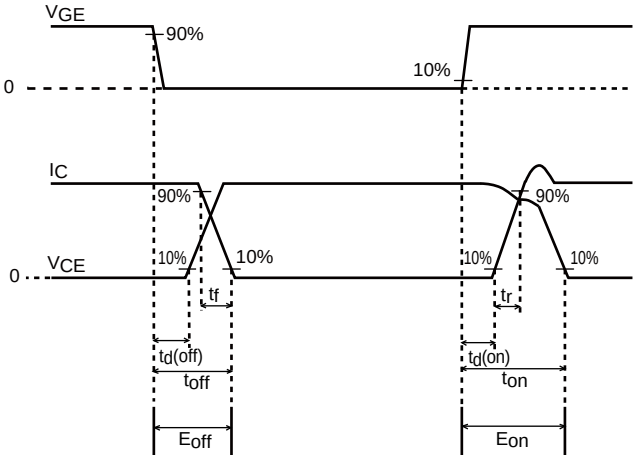
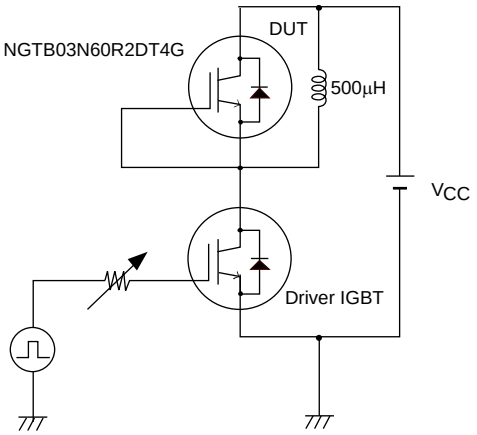


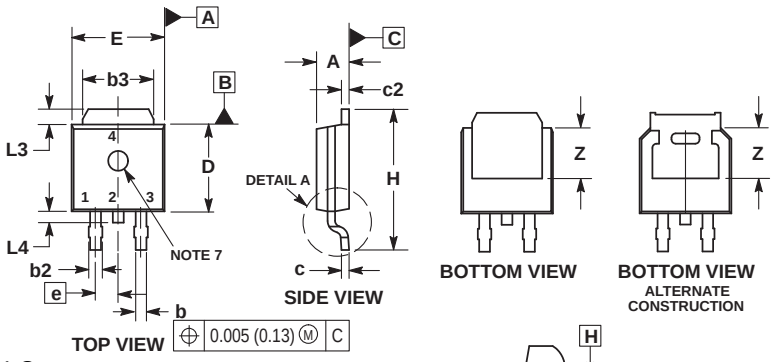
Fig.3 Reverse Recovery Time Test Circuit



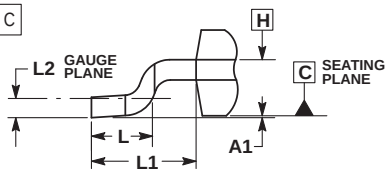
Package Dimensions

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

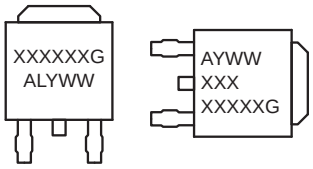
STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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

GENERIC MARKING DIAGRAM*

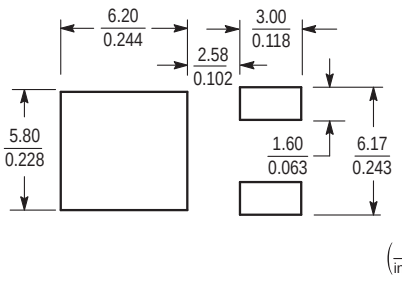


IC **Discrete**

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.

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.

ORDERING INFORMATION

Device	Package	Shipping	note
NGTB03N60R2DT4G	DPAK	2500 pcs. / reel	Pb-Free And Halogen Free