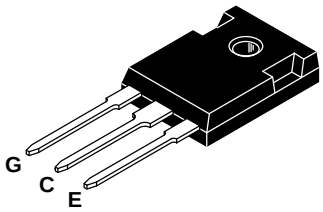
FIR20N120TDG

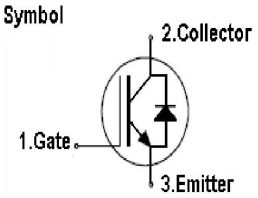
IGBT

PIN Connection TO-3P/TO-247



Features

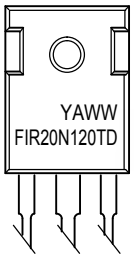
- 1200V,20A,Vce(on)(typ)=2.3V@Vge=15V
- High speed switching
- Higher system efficiency
- Soft current turn-off waveforms
- Square RBSOA using NPT technology



General Description

First semi NPT IGBTs offer lower losses and higher energy efficiency for application such as IH (induction heating), UPS,General inverter and other soft switching applications.

Marking Diagram



Y = Year
A = Assembly Location
WW = Work Week
FIR20N120TD= Specific Device Code

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 30	V
I_C	Continuous Collector Current (T_C=25℃)	40	A
	Continuous Collector Current (T_C=100℃)	20	A
I_{CM}	Pulsed Collector Current (Note 1)	80	A
I_F	Diode Continuous Forward Current (T_C=100℃)	15	A
I_{FM}	Diode Maximum Forward Current (Note 1)	80	A
t_{sc}	Short Circuit Withstand Time	10	us
P_D	Maximum Power Dissipation (T_C=25℃)	192	W
	Maximum Power Dissipation (T_C=100℃)	76	W
T_J	Operating Junction Temperature Range	-55 to +150	℃
T_{STG}	Storage Temperature Range	-55 to +150	℃

Thermal Characteristics

Symbol	Parameter	Max.	Units
$R_{th\ j\text{-}c}$	Thermal Resistance, Junction to case for IGBT	0.45	℃/ W
$R_{th\ j\text{-}c}$	Thermal Resistance, Junction to case for Diode	0.85	℃/ W
$R_{th\ j\text{-}a}$	Thermal Resistance, Junction to Ambient	40	℃/ W

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Electrical Characteristics (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE}= 0V, I_C= 250uA	1200	-	-	V
I_{CES}	Collector-Emitter Leakage Current	V_{CE}= 1200V, V_{GE}= 0V	-	-	25	uA
I_{GES}	Gate Leakage Current, Forward	V_{GE}=30V, V_{CE}= 0V	-	-	100	nA
	Gate Leakage Current, Reverse	V_{GE}= -30V, V_{CE}= 0V	-	-	-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}= V_{CE}, I_C= 250uA	4.5	5.0	5.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C= 20A	-	2.3	2.7	V
Q_g	Total Gate Charge	V_{CC}=600V V_{GE}=15V I_C=20A	-	100	120	nC
Q_{ge}	Gate-Emitter Charge		-	22	25	nC
Q_{gc}	Gate-Collector Charge		-	45	50	nC
$t_{d(on)}$	Turn-on Delay Time	V_{CC}=600V V_{GE}=15V I_C=20A R_G=28Ω Inductive Load T_C=25 ℃	-	45	-	ns
t_r	Turn-on Rise Time		-	55	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	350	-	ns
t_f	Turn-off Fall Time		-	80	-	ns
Eon	Turn-on Switching Loss		-	2.7	-	mJ
Eoff	Turn-off Switching Loss		-	0.95	-	mJ
Ets	Total Switching Loss		-	3.65	-	mJ
C_{ies}	Input Capacitance	V_{CE}=25V V_{GE}=0V f = 100kHz	-	619	-	pF
C_{oes}	Output Capacitance		-	109	-	pF
C_{res}	Reverse Transfer Capacitance		-	46	-	pF
R_{Gint}	Integrated gate resistor		2.0	2.5	3.0	Ω

Electrical Characteristics of Diode (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_F	Diode Forward Voltage	I_F=15A	-	1.35	1.5	V
t_{rr}	Diode Reverse Recovery Time	V_{CE} = 600V I_F= 15A dI_F/dt = 500A/us	-	210	245	ns
I_{rr}	Diode peak Reverse Recovery Current		-	27	30	A
Q_{rr}	Diode Reverse Recovery Charge		-	3300	3700	nC

Notes：

1. Repetitive Rating: Pulse width limited by maximum junction temperature

Typical Performance Characteristics

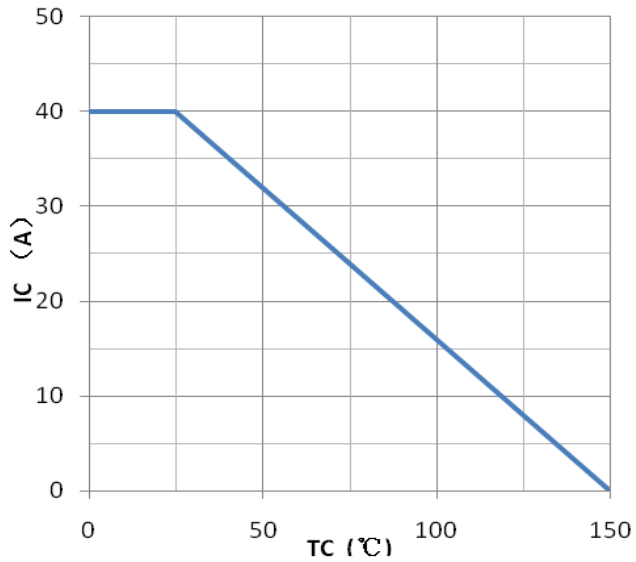


Figure1:maximum DC collector current VS. case temprature

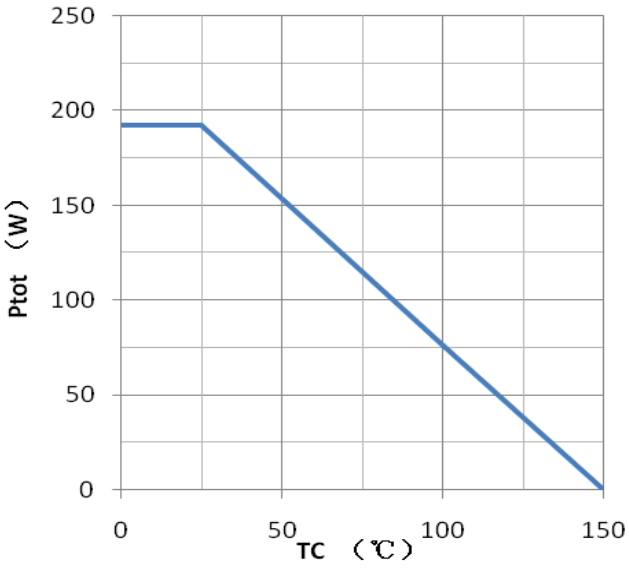


Figure2:power dissipation VS. case temprature

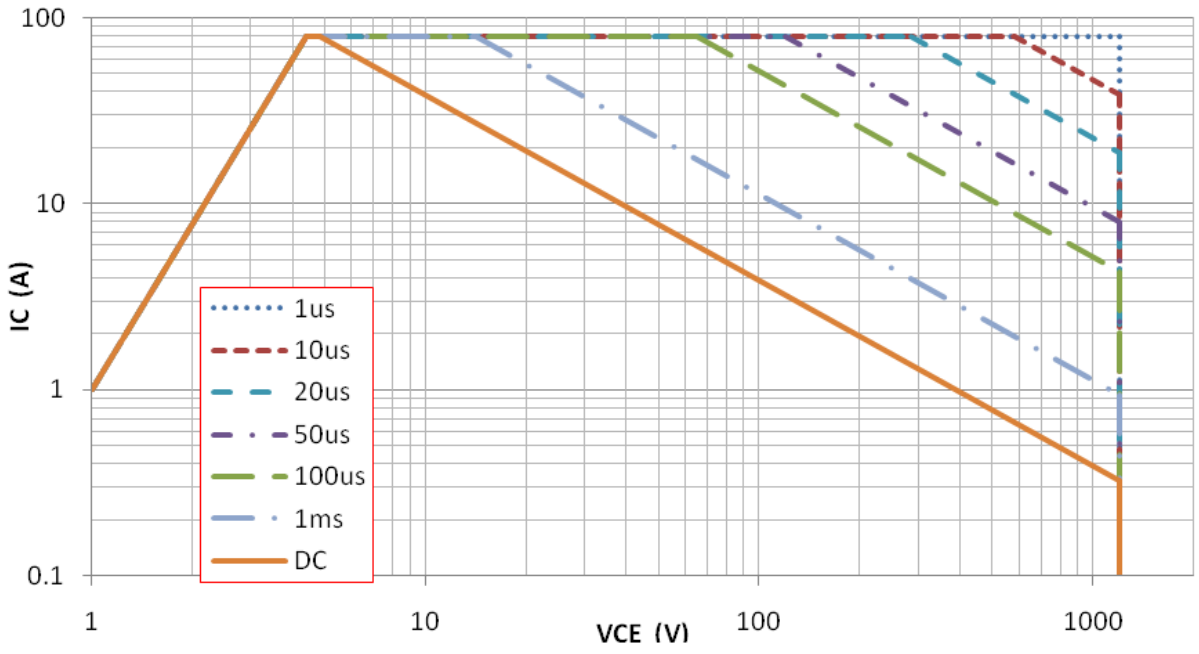


Figure3:forward SOA,TC=25℃,TJ≤150℃

Typical Performance Characteristics

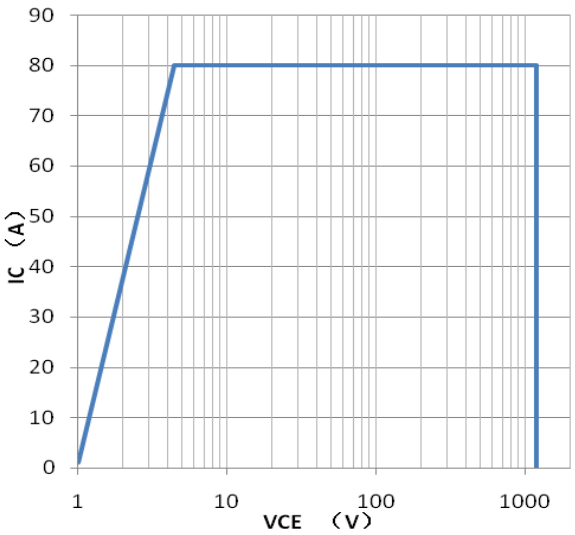


Figure4:reverse bias SOA,TJ=150℃,VGE=15V

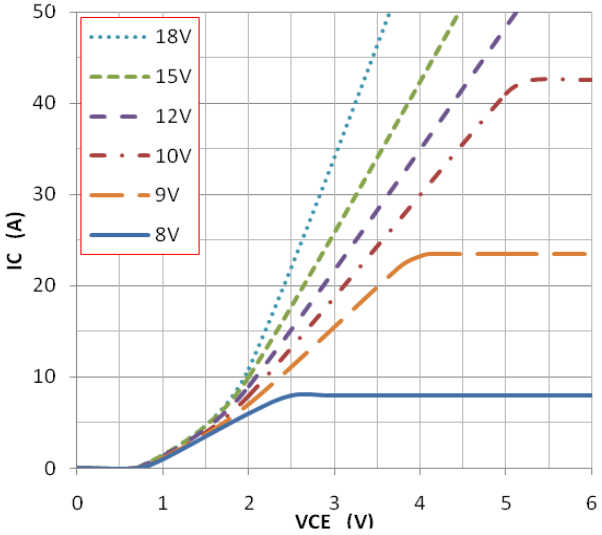


Figure5:typical IGBT output characteristics, TJ=25℃;tp=300us

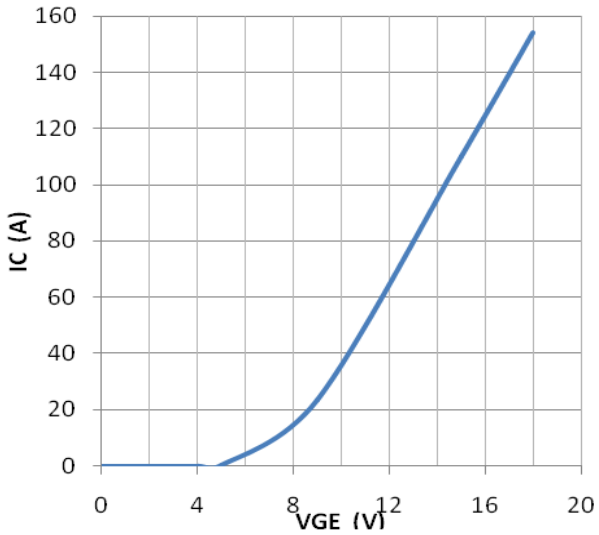


Figure6:typical trans characteristics,VCE=20V,tp=20us

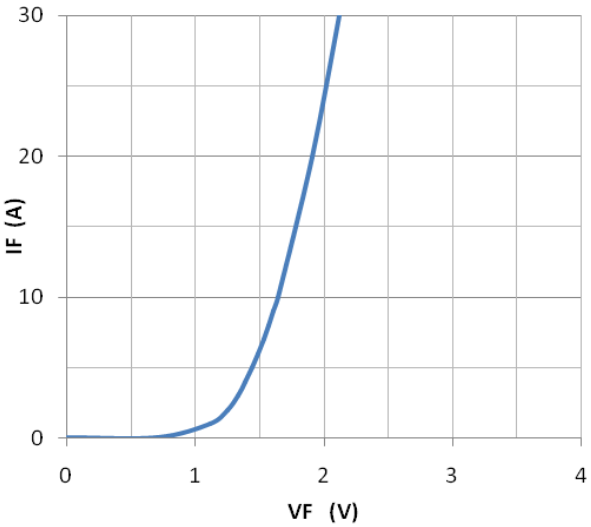


Figure7:typical diode forward characteristic,tp=300us

Typical Performance Characteristics

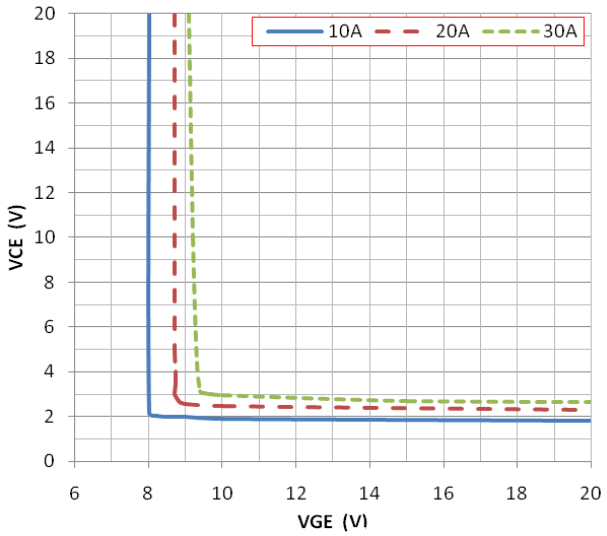


Figure8:typical VCE VS. VGE,TJ=25℃

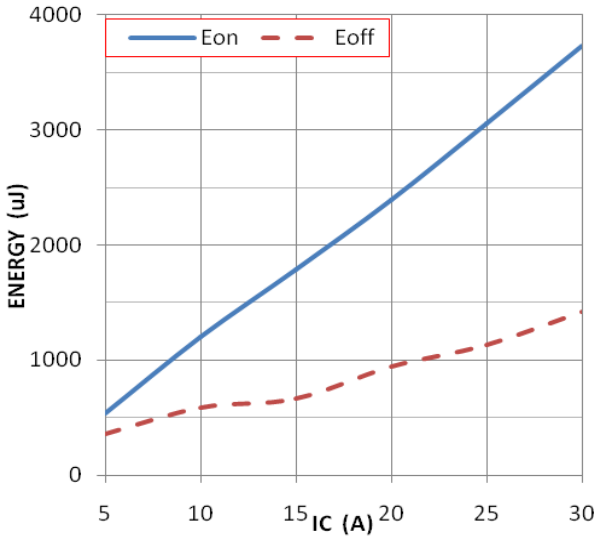


Figure9:typical energy loss VS. IC, TC=25℃,L=500uH, VCE=600V,VGE=15V,Rg=28Ω

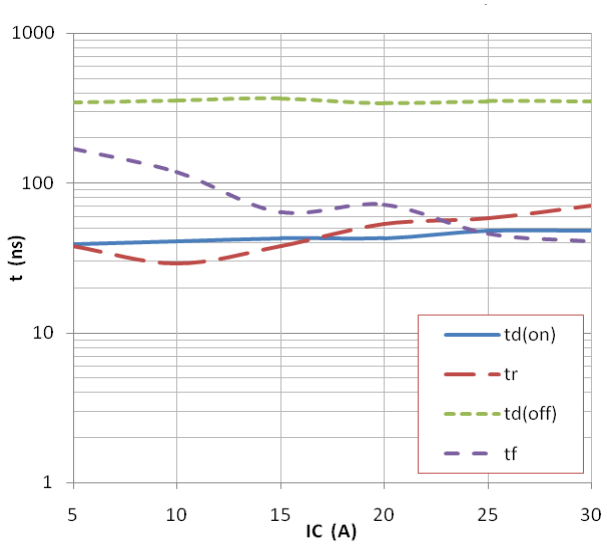


Figure10: typical switching time VS. IC, TC=25℃, L=500uH, VCE=600V,VGE=15V,Rg=28Ω

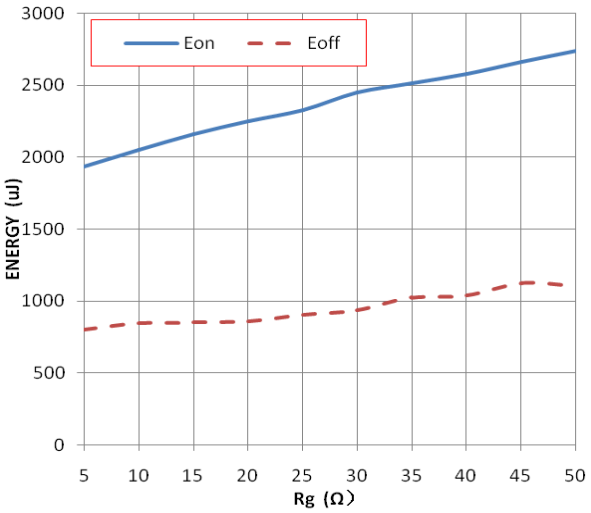


Figure11:typical energy loss VS. Rg,TC=25℃, L=500uH,VCE=600V,VGE=15V,IC=20A

Typical Performance Characteristics

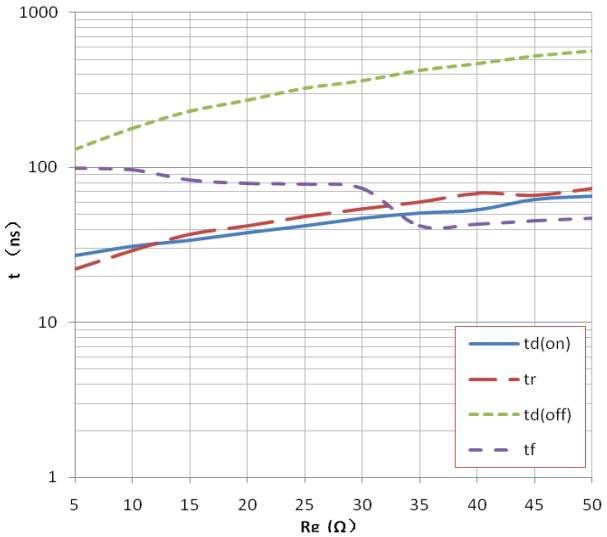


Figure11:typical switching time VS. Rg,TC=25℃ ,

L=500uH,VCE=600V,VGE=15V,IC=20A

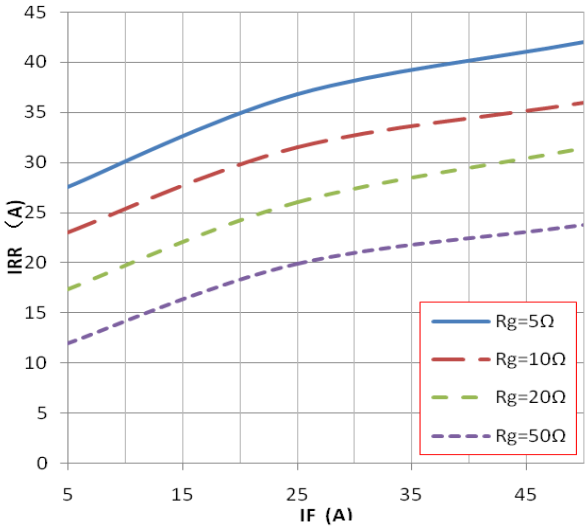


Figure12:typical diode IRR VS. IF, TC=25℃

VCC=600V,VGE=15V

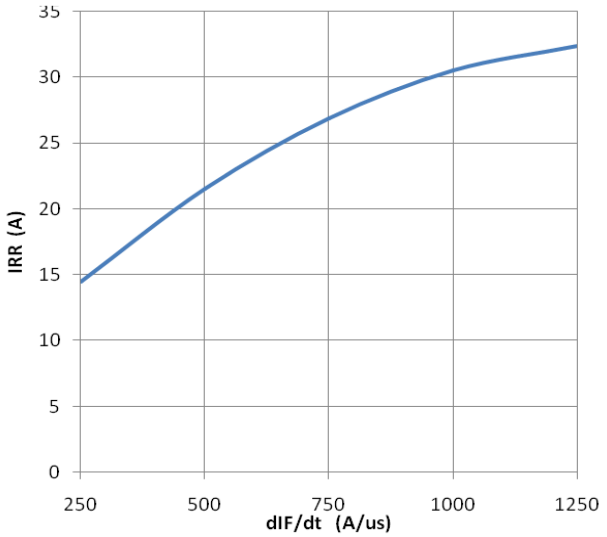


Figure13:typical diode IRR VS. dIF/dt

VCC=600V,VGE=15V,IF=20A

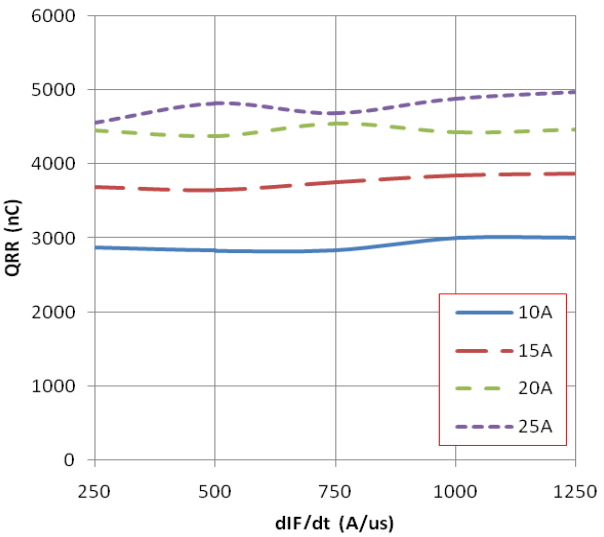


Figure14:typical diode QRR VS. dIF/dt

VCC=600V,VGE=15V

Typical Performance Characteristics

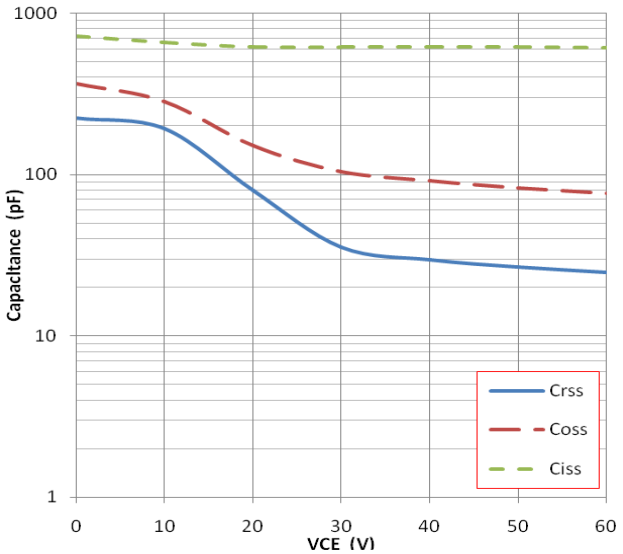


Figure15:typical capacitance VS. VCE,VGE=0V,f=100kHz

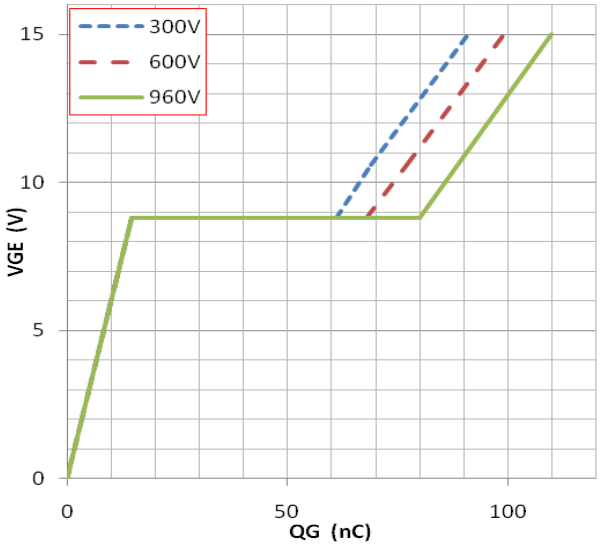


Figure16:typical gate charge VS. VGE,IC=20A

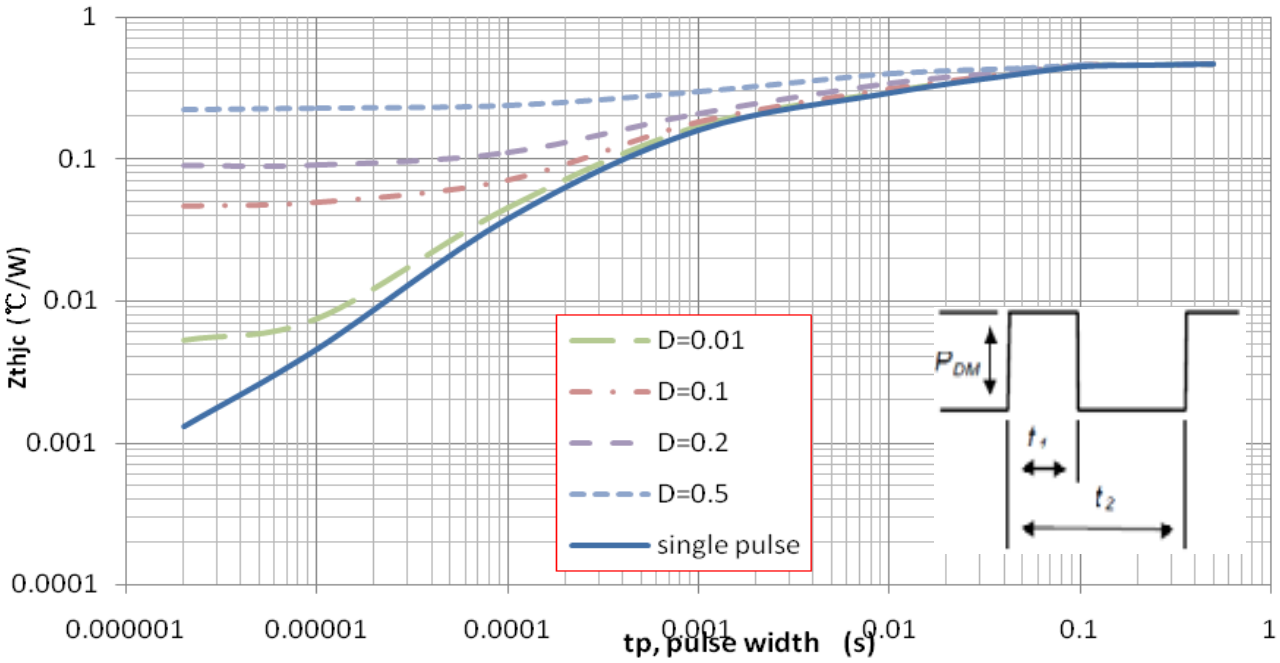
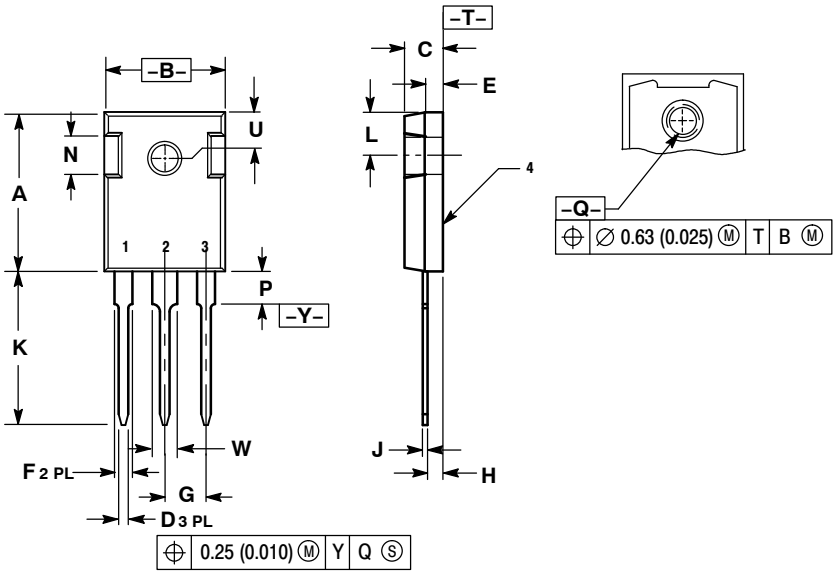


Figure19:normalized transient trermal impedance,junction-to-case

Note1.Duty factor D=t1/t2; Note2:peak TJ=PDM×Zthjc+TC

Package Dimensions

TO-3P/TO-247



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	8.30
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	1.90	2.60	0.075	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	19.81	20.83	0.780	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

STYLE 2:
PIN 1. ANODE
2. CATHODE (S)
3. ANODE 2
4. CATHODES (S)