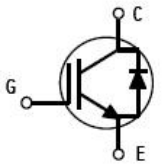
Insulated Gate Bipolar Transistor

V_{CES}	650	V
I_C	60	A
P_{tot} (TC=25℃)	406	W
$V_{CE(sat)}$	1.85	V

General Description：

Using DongHai's proprietary Planar design and advanced FS technology, the 650V FS IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation.

TO-3PN PACKAGE



Features：

- FS Trench Technology, Positive temperature coefficient
- Low saturation voltage: $V_{CE(sat)}$, typ = 1.85V
  @ I_C =60A and T_C = 25°C
- Extremely enhanced avalanche capability

Applications：

Aircondition、Welding、UPS…

Absolute Maximum Ratings（Tc= 25℃ unless otherwise specified）：

Symbol	Parameter	Rating	Units
V_{CES}	Collector-Emitter Voltage	650	V
V_{GES}	Gate- Emitter Voltage	±20	V
I_C	Collector Current	120	A
	Collector Current @TC = 100 °C	60	
I_{CM}[a1]	Pulsed Collector Current	180	A
I_F	Diode Continuous Forward Current @TC = 100 °C	30	A
I_{FM}	Diode Maximum Forward Current	90	A
P_D	Power Dissipation @ TC = 25°C	406	W
	Power Dissipation @TC = 100 °C	163	
T_J	Operating Junction	150	℃
T_{stg}	Storage Temperature Range	−55～150	℃
T_L	Maximum Temperature for Soldering	270	℃

a1：The pulse width is limited by the maximum junction temperature

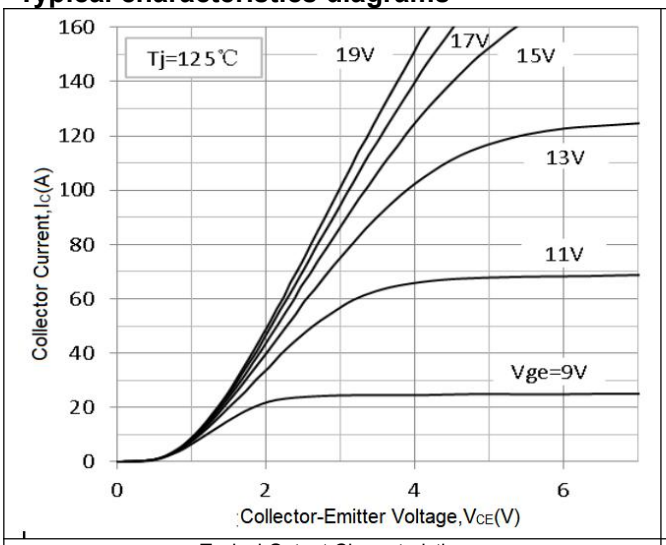
Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R\theta_{JC}$	Thermal Resistance, Junction to case for IGBT	--	0.446	℃/W
$R\theta_{JC}$	Thermal Resistance, Junction to case for Diode	--	1.25	℃/W
$R\theta_{JA}$	Thermal Resistance, Junction to Ambient	--	40	℃/W

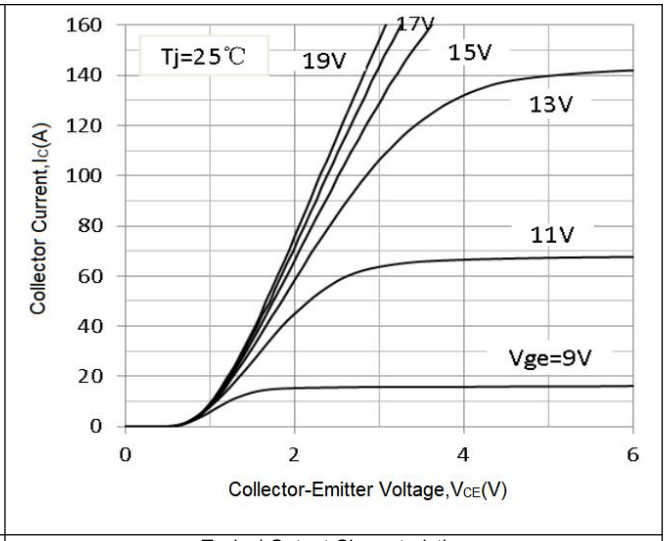
Electrical Characteristics of the IGBT（Tc= 25℃ unless otherwise specified）：

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
OFF Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=250uA	650	720	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE}=0V,V_{CE}=650V	--	--	3.0	mA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE}=+20V	--	--	+250	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	V_{GE} =-20V	--	--	-250	nA
ON Characteristics						
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=60A ,V_{GE}=15V	--	1.85	2.4	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA ,V_{CE}=V_{GE}	4.0	5.4	7.0	V
Pulse width tp≤300μs,δ≤2%						
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE}=30V,V_{GE}=0V f=1MHz	--	3398	--	pF
C_{oes}	Output Capacitance		--	224	--	
C_{res}	Reverse Transfer Capacitance		--	44	--	
Resistive Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=400V,I_C=60A, R_g=10Ω ,V_{GE}=15V, Inductive Load,Ta=25℃，	--	66	--	ns
t_r	Rise Time		--	124	--	
$t_{d(off)}$	Turn-Off Delay Time		--	152	--	
t_f	Fall Time		--	51	--	
E_{on}	Turn-On Switching Loss		--	4.79	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.39	--	
E_{ts}	Total Switching Loss		--	6.18	--	
$t_{d(on)}$	Turn-on Delay Time	V_{CE}=400V,I_C=60A, R_g=10Ω ,V_{GE}=15V, Inductive Load,Ta=25℃，	--	66	--	ns
t_r	Rise Time		--	112	--	
$T_{d(off)}$	Turn-Off Delay Time		--	167	--	
t_f	Fall Time		--	50	--	
E_{on}[a2]	Turn-On Switching Loss		--	4.73	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.50	--	
E_{ts}	Total Switching Loss		--	6.23	--	
Q_g	Total Gate Charge	V_{CE}=400V,I_C=60A, V_{GE}=15V,	--	117	--	nC
Q_{ge}	Gate to Emitter Charge		--	35	--	
Q_{gc}	Gate to Collector Charge		--	47	--	
Electrical Characteristics of the DIODE						
V_F	Diode Forward Voltage	I_F=30A	--	1.3	1.8	V
t_{rr}	Reverse Recovery Time	I_F=30A di/dt=200A/uS	--	80	--	ns
I_{rrm}	Diode Peak Reverse Recovery Current		--	6	--	A
Q_{rr}	Reverse Recovery Charge		--	240	--	nC
Pulse width t tp≤300μs,δ≤2%						

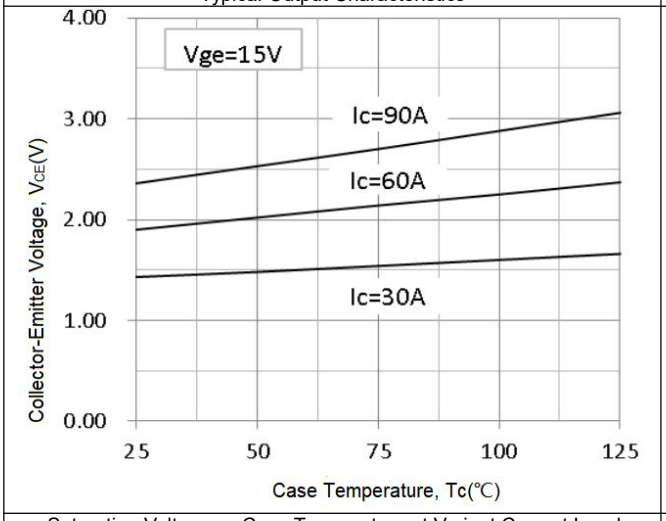
Typical characteristics diagrams



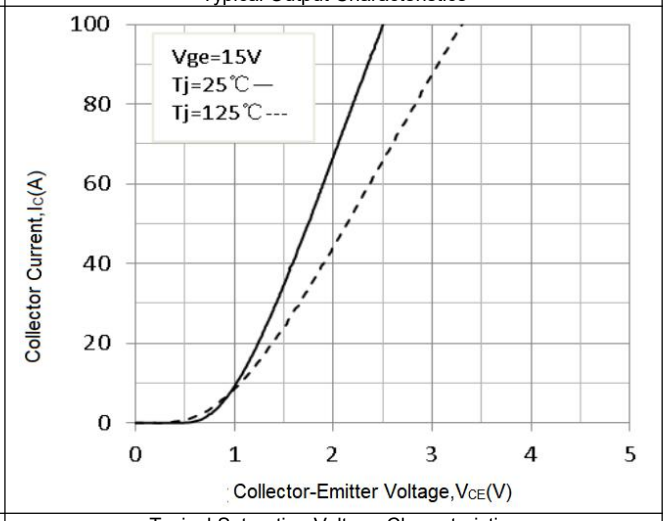
Typical Output Characteristics



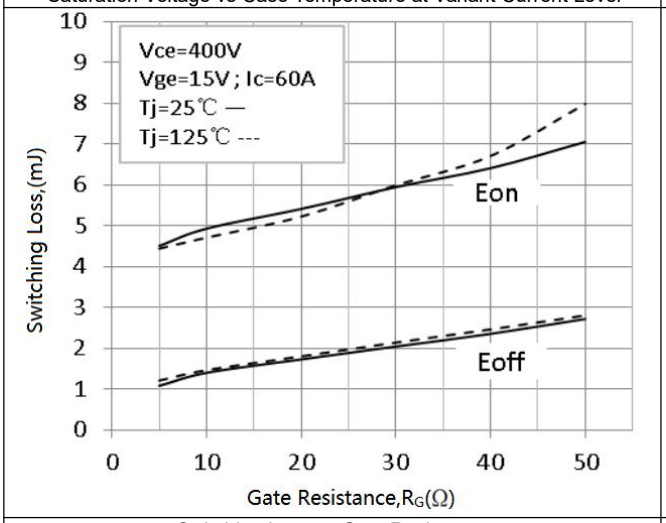
Typical Output Characteristics



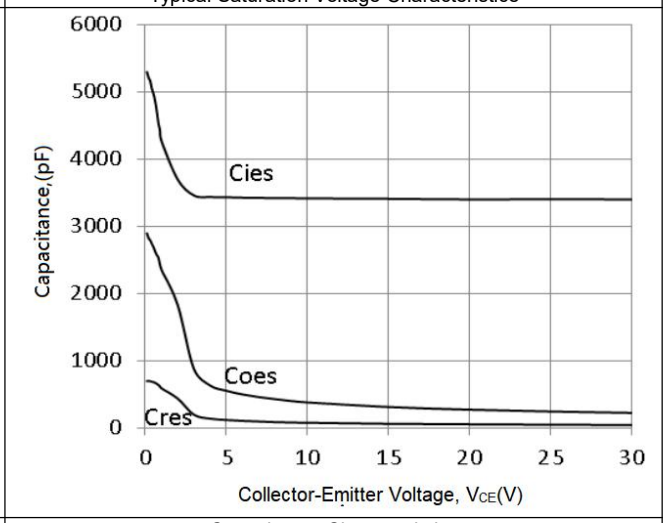
Saturation Voltage vs Case Temperature at Variant Current Level



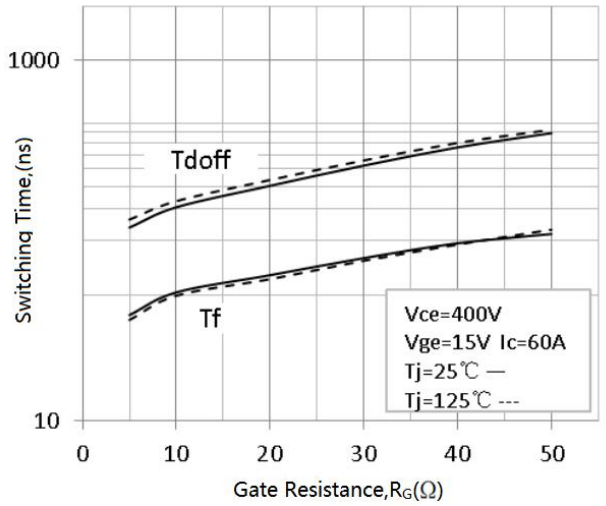
Typical Saturation Voltage Characteristice



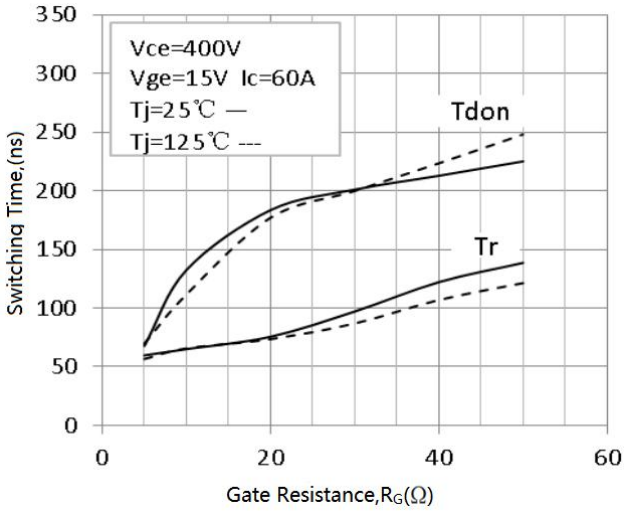
Switching Loss vs Gate Resistance



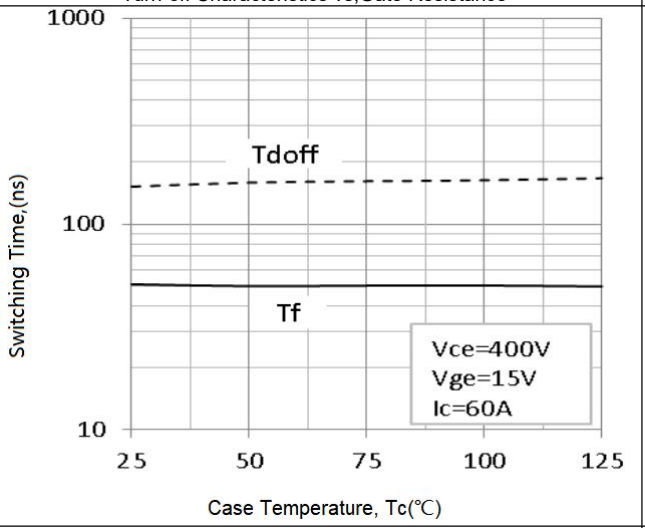
Capacitance Characteristics



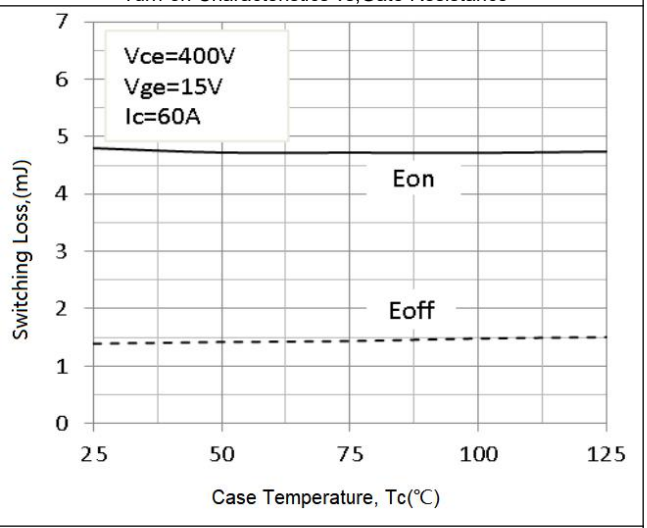
Turn-off Characteristics vs,Gate Resistance



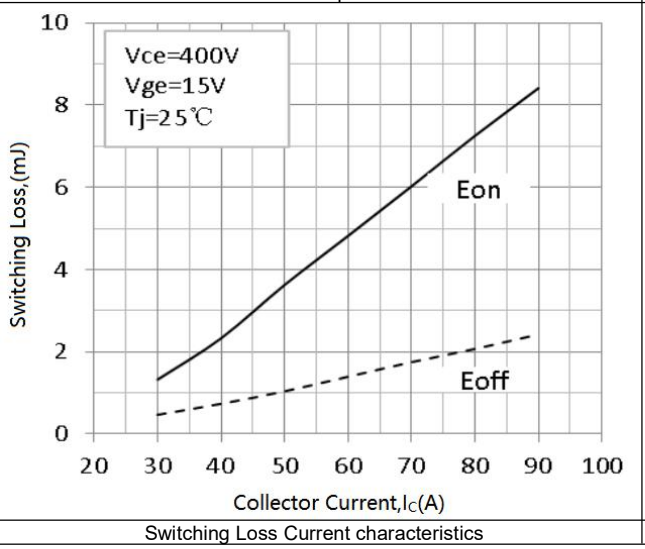
Turn-on Characteristics vs,Gate Resistance



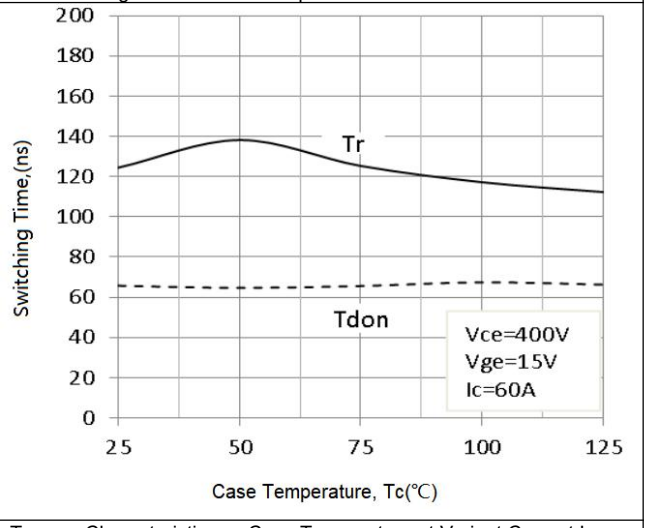
Turn-off Characteristice vs Case Temperature at Variant Current Leve



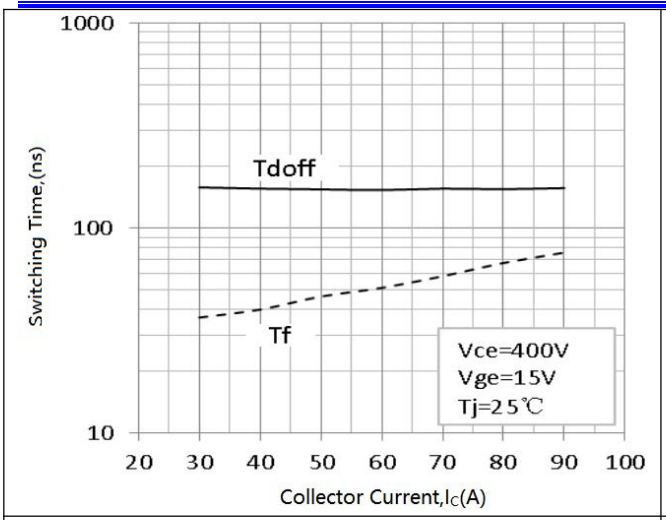
Switching Loss vs Case Temperature at Variant Current Level



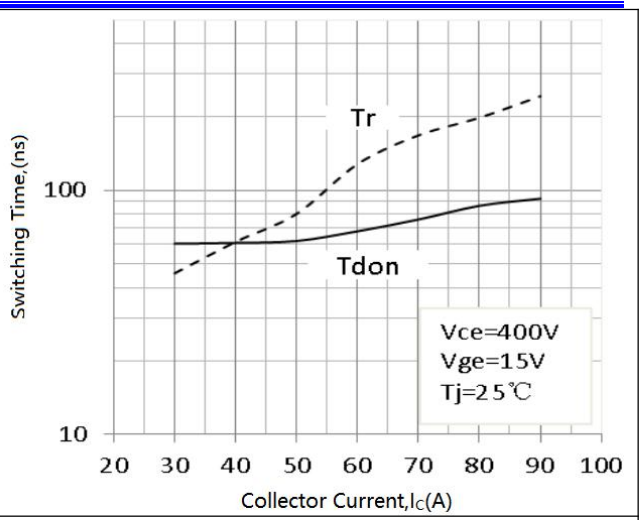
Switching Loss Current characteristics



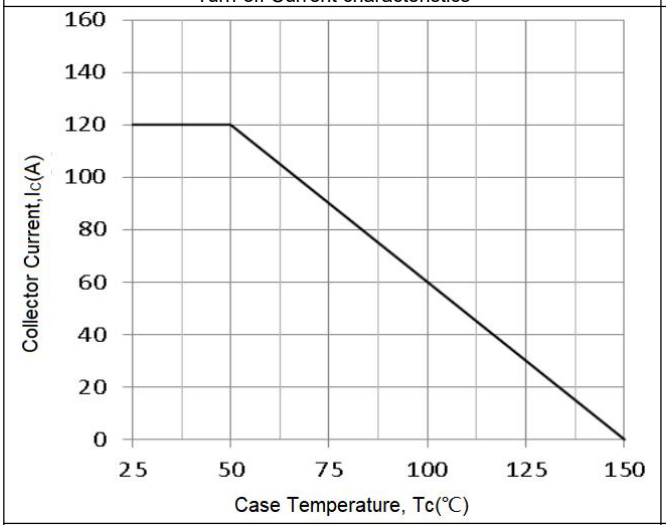
Turn-on Characteristics vs Case Temperature at Variant Current Leve



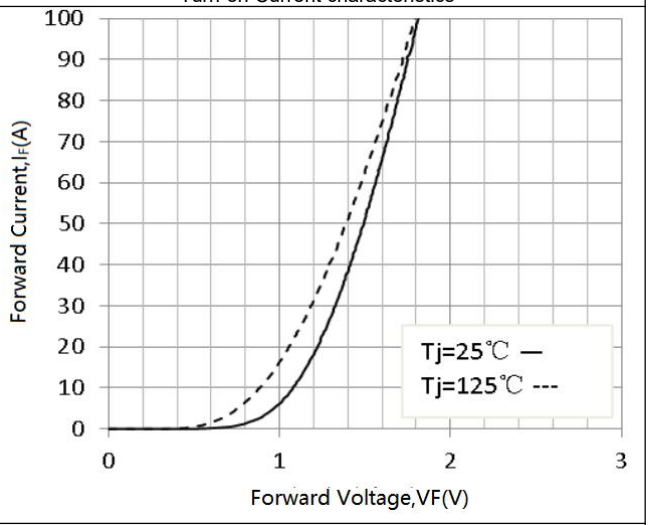
Turn-off Current characteristics



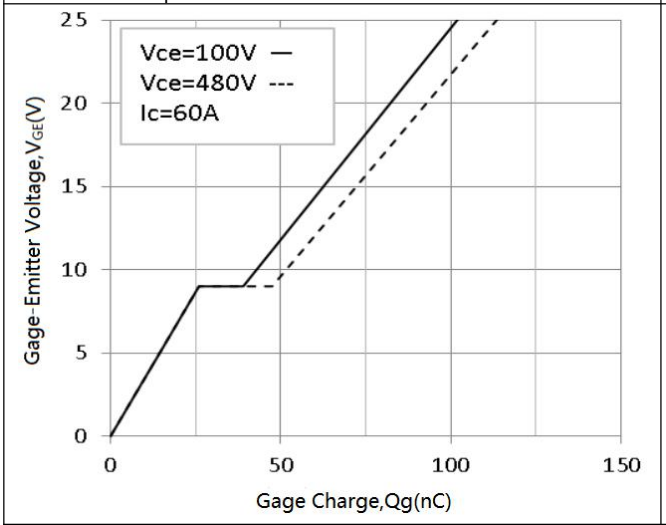
Turn-on Current characteristics



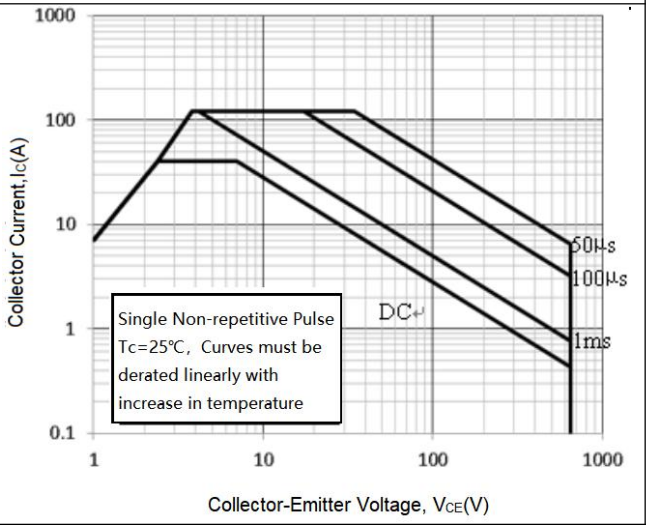
Temperature characteristics of collector current



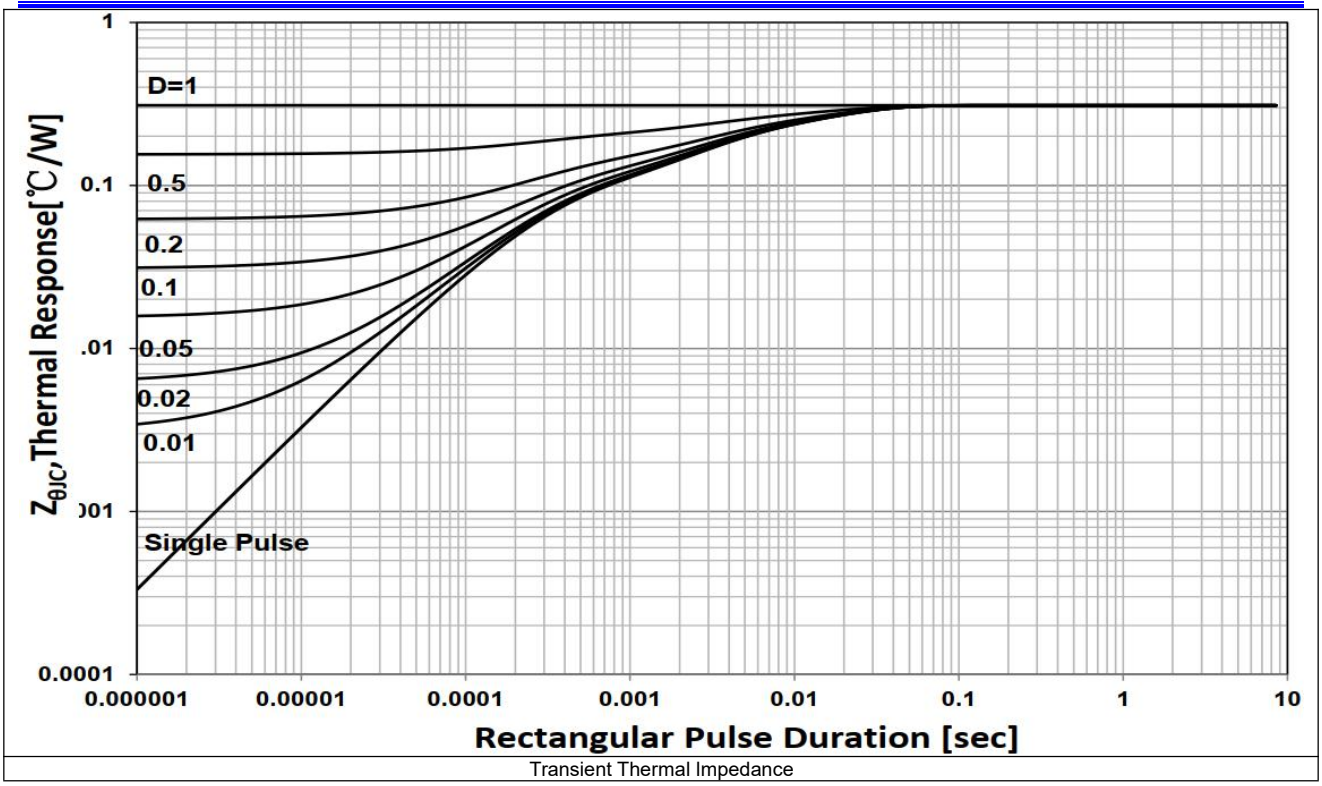
Forward Characteristics



Gate charge Characteristice



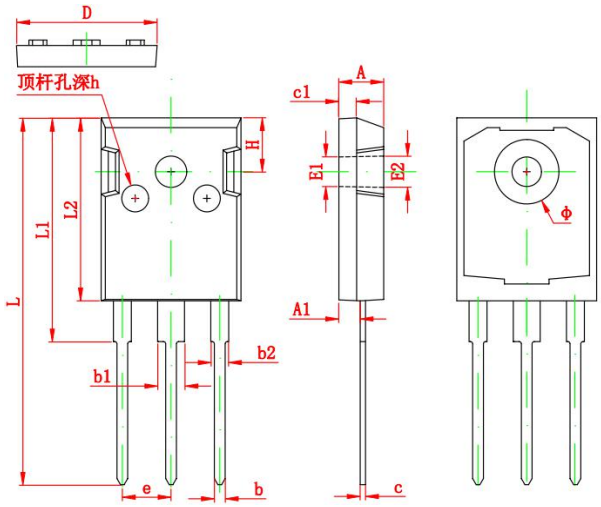
SOA Characteristics



Transient Thermal Impedance

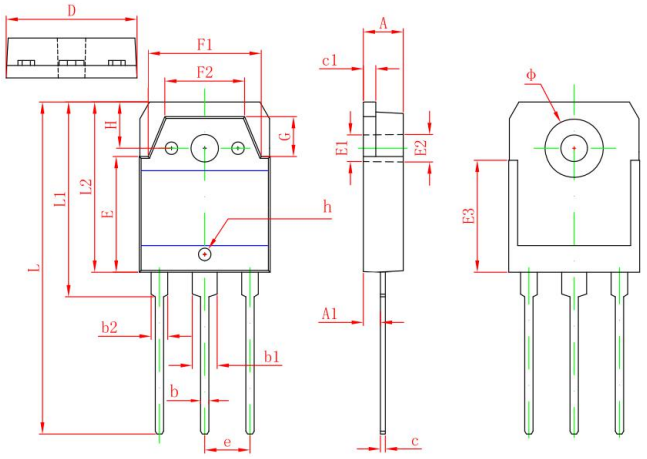
Dimensions

TO-247 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.850	5.150	0.191	0.200
A1	2.200	2.600	0.087	0.102
b	1.000	1.400	0.039	0.055
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.900	2.100	0.075	0.083
D	15.450	15.750	0.608	0.620
E1	3.500 REF		0.138 REF	
E2	3.600 REF		0.142 REF	
L	40.900	41.300	1.610	1.626
L1	24.800	25.100	0.976	0.988
L2	20.300	20.600	0.799	0.811
Φ	7.100	7.300	0.280	0.287
e	5.450 TYP		0.215 TYP	
H	5.980 REF		0.235 REF	
h	0.000	0.300	0.000	0.012

TO-3PN PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.600	5.000	0.181	0.197
A1	2.200	2.600	0.087	0.102
b	0.800	1.200	0.031	0.047
b1	2.800	3.200	0.110	0.126
b2	1.800	2.200	0.071	0.087
c	0.500	0.700	0.020	0.028
c1	1.450	1.650	0.057	0.065
D	15.450	15.850	0.608	0.624
E	13.700	14.100	0.539	0.555
E1	3.200 REF		0.126 REF	
E2	3.300 REF		0.130 REF	
E3	13.450 REF		0.530 REF	
F1	13.400	13.800	0.528	0.543
F2	9.400	9.800	0.370	0.386
L	39.900	40.300	1.571	1.587
L1	23.200	23.600	0.913	0.929
L2	20.300	20.600	0.799	0.811
Φ	6.900	7.100	0.272	0.280
G	5.150	5.550	0.203	0.219
e	5.450 TYP		0.215 TYP	
H	5.000 REF		0.197 REF	
h	0.000	0.300	0.000	0.012