

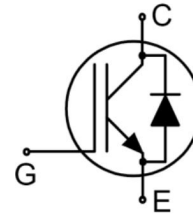
Features

- Very Low Saturation Voltage:
 $V_{CE(sat)} = 1.35V @ I_C = 100A$
- Maximum Junction Temperature: $T_J = 175^{\circ}C$
- Positive Temperature Co-Efficient
- Tight Parameter Distribution
- High Input Impedance



Applications

- Traction Inverter for HEV/EV
- Auxiliary DC/AC Converter
- Motor Drives
- Other Power-Train Applications
Requiring High Power Switch



Absolute Ratings($T_c=25^{\circ}C$)

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{ce}	650	V
Collector Current-continuous	$I_C, T=25^{\circ}C$ $T=100^{\circ}C$	400	A
		200	A
Diode forward current	$I_F, T=25^{\circ}C$ $T_c=100^{\circ}C$	400	A
		200	A
Collector Current-pulse (note 1)	I_{CM}	600	A
Gate-Emitter Voltage	V_{GES}	± 20	V
Power Dissipation	PD $T_c=25^{\circ}C$ $T_c=100^{\circ}C$	995	W
		596	
Operating Temperature Range	T_J	$-40 \sim +175$	$^{\circ}C$
Storage Temperature Range	T_{STG}	$-55 \sim +150$	$^{\circ}C$
Short Circuit Withstand Time(note 2)	t_{sc}	5	us
Maximum Lead Temperature for Soldering Purposes	T_L	260	$^{\circ}C$
Isolation Voltage for Case-Terminal	V_{ISO}	2.5	KV

Electrical Characteristics

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Off-Characteristics						
Collector-Emitter Voltage	BV_{CES}	$I_C=100\mu A, V_{GE}=0V$	650	-	-	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_C=25^\circ C$	-	-	100	μA
Gate-body leakage current, forward	I_{GESF}	$V_{CE}=0V, V_{GE}=20V$	-	-	100	nA
Gate-body leakage current, reverse	I_{GESR}	$V_{CE}=0V, V_{GE}=-20V$	-	-	-100	nA
On-Characteristics						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=250\mu A$	3.5	5.0	6.3	V
Collector-Emitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_C=100A$	-	1.35	1.60	V
Dynamic Characteristics						
Input capacitance	C_{ies}	$V_{CE}=30V, V_{GE}=0V, f=1.0MHz$	-	5056	-	pF
Output capacitance	C_{oes}		-	480	-	pF
Reverse transfer capacitance	C_{res}		-	110	-	pF
Transconductance	g_{fs}	$I_C=60A, V_{CE}=10V$ (Note 3)	30	50	-	S
Short-circuit collector current	I_{SC}	$V_{CC} \leq 600V, V_{GE} = 15V, t_{SC} \leq 5\mu s$ (Note 4)	-	1600	-	A

Electrical Characteristics

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Switching Characteristics						
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V, I_C=200A, R_G=4.7\Omega, V_{GE}=15V, \text{ Inductive Load } T_C=25^\circ C$	-	83	-	ns
Turn-On rise time	t_r		-	145	-	ns
Turn-Off delay time	$t_{d(off)}$		-	215	-	ns
Turn-Off Fall time	t_f		-	131	-	ns
Turn-on Loss	E_{on}		-	5.4	-	mJ
Turn-off Loss	E_{off}		-	3.8	-	mJ
Total Loss	E_{ts}		-	9.2	-	mJ
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V, I_C=200A, R_G=4.7\Omega, V_{GE}=15V,$	-	80	-	ns
Turn-On rise time	t_r		-	160	-	ns

Turn-Off delay time	t _{d(off)}	Inductive Load Tc=125℃	-	244	-	ns
Turn-Off Fall time	t _f		-	166	-	ns
Turn-on switching Loss	E _{on}		-	9.7	-	mJ
Turn-off switching Loss	E _{off}		-	5.2	-	mJ
Total switching Loss	E _{ts}		-	14.9	-	mJ
Gate Charge	Qg	V _{CC} =400V,Ic=100A V _{GE} =15V	-	157	-	nC
Gate to Emitter Charge	Qge		-	43	-	nC
Gate to Collector Charge	Qgc		-	64	-	nC
Anti-Parallel Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Voltage	V _F	I _F =60A(T _J =25℃)	-	1.18	1.40	V
Diode Reverse recovery time	t _{rr}	I _F =200A dI _F =/dt=200A/us T _J =25℃	-	60	-	ns
Diode Reverse recovery charge	Q _{rr}		-	164	-	nC

Thermal Characteristic

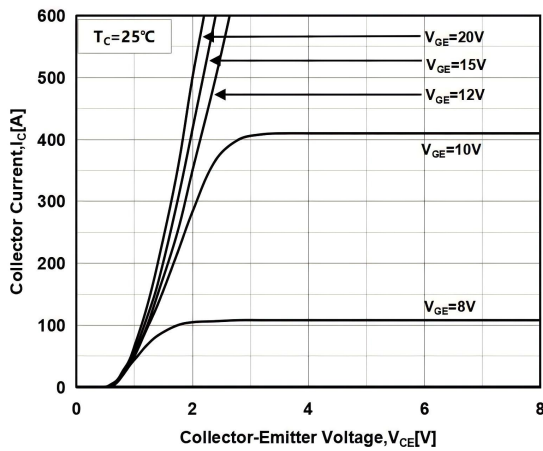
Parameter	Symbol	Max	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{th(j-c)}$	0.15	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to Case (Diode)	$R_{th(j-c)}$	0.4	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	25	$^{\circ}\text{C}/\text{W}$

Notes:

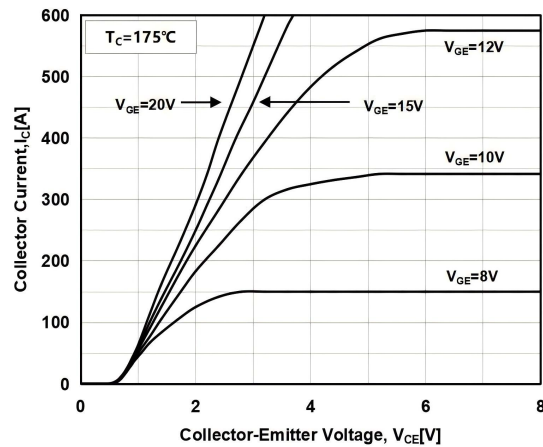
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $V_{GE}=15\text{V}, V_{CE}=360\text{V}, T_J=150^{\circ}\text{C}$, $R_G=10\Omega$, Non Repetitive
3. Switching times & energy losses may increase for higher $V_{CE}(\text{clamp})$, T_J or R_G
4. Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}$

Electrical Characteristics (curves)

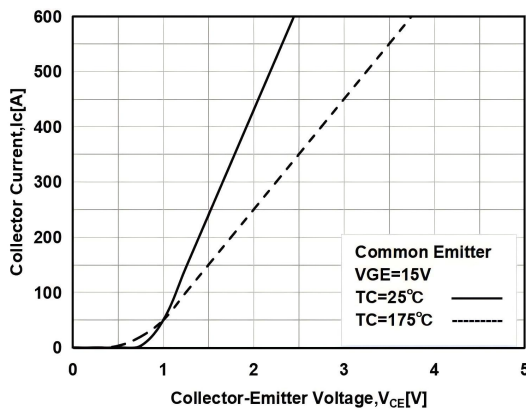
Typical Output Characteristics



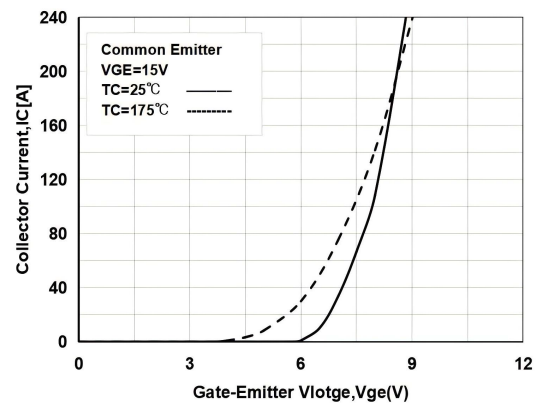
Typical Output Characteristics



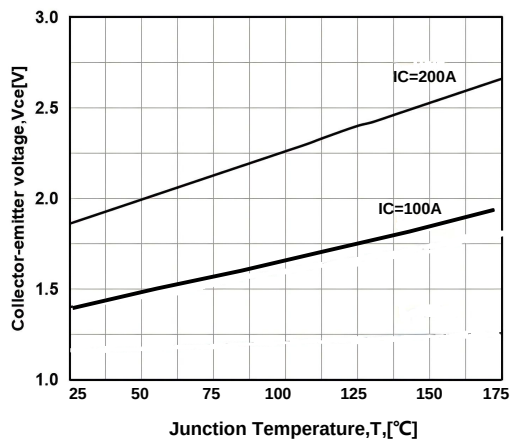
Typical Saturation Voltage Characteristics



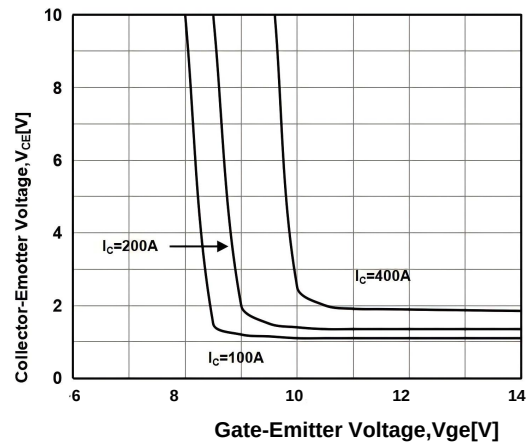
Transfer Characteristics



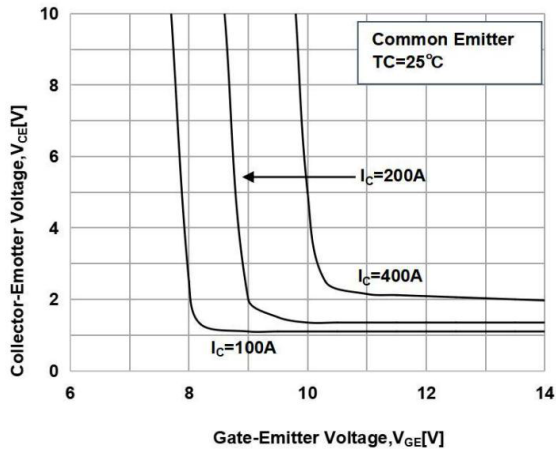
Saturation Voltage vs. Junction temperature at Variant Current Level



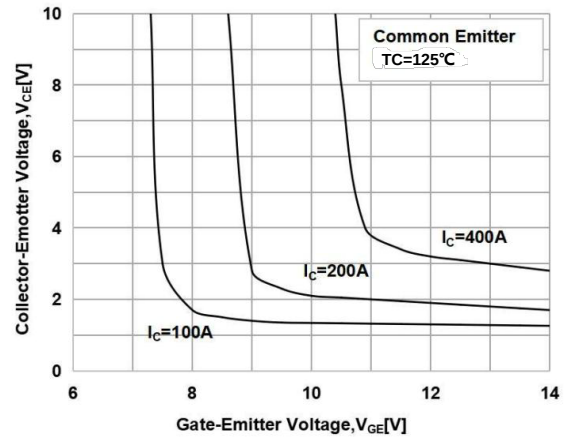
Saturation Voltage vs. V_{GE}



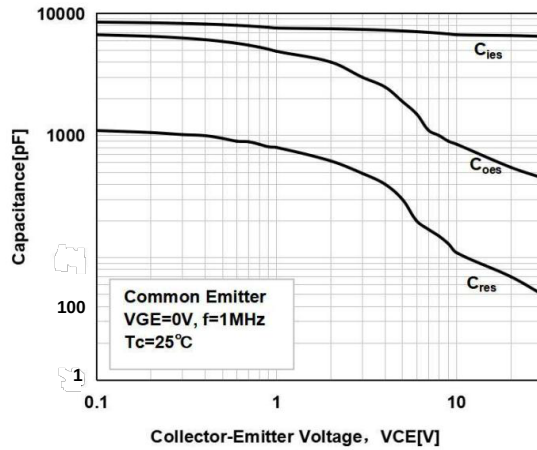
Saturation Voltage vs. V_{GE}



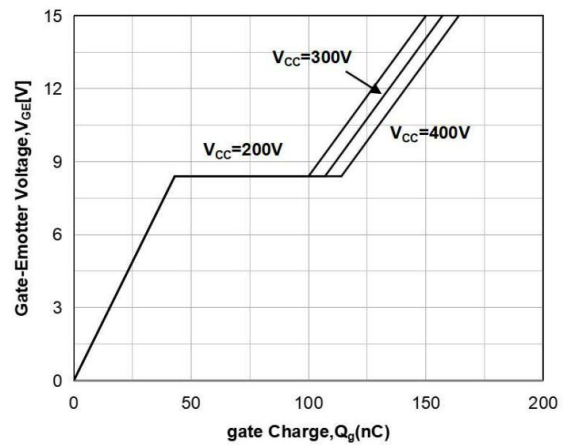
Saturation Voltage vs. V_{GE}



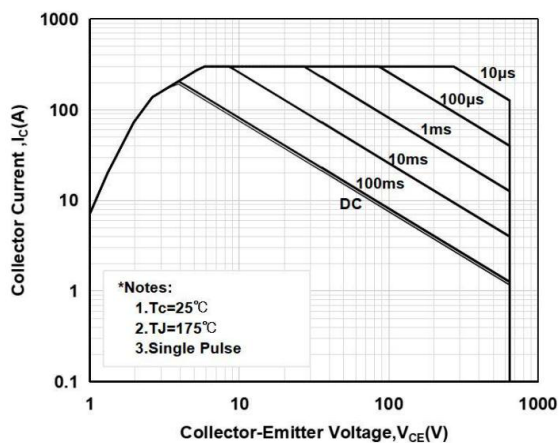
Capacitance Characteristics



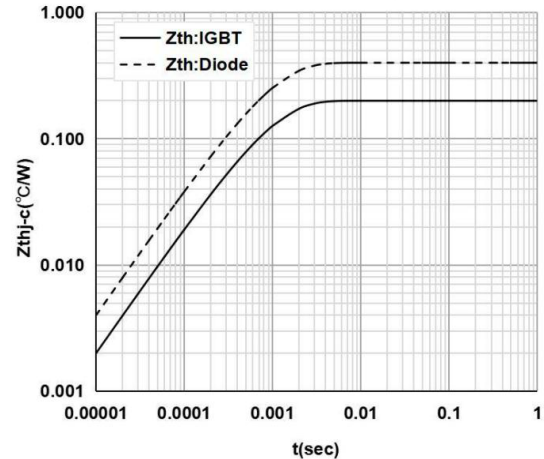
Gate Charge Characteristics



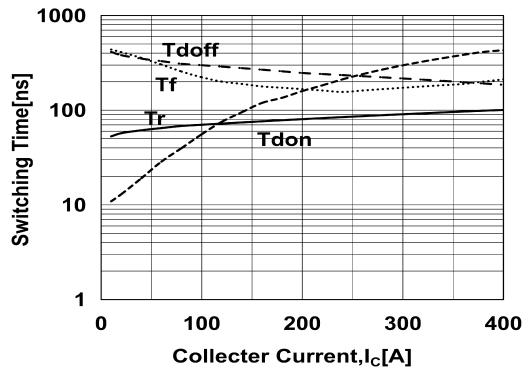
Foward Bias Safe Operating Area



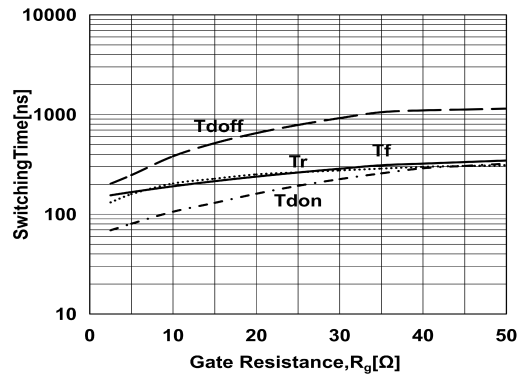
Transient Thermal Impedance



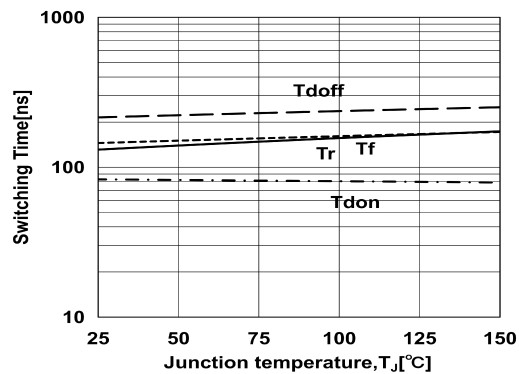
Switching Time vs. I_c (125°C)
 $V_{ce}=400V, V_{ge}=15V, R_g=4.7\Omega$



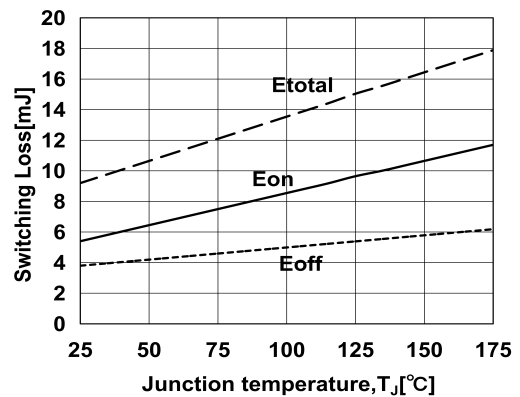
Switching Time vs. R_g (125°C)
 $V_{CE}=200V, V_{ge}=15V, I_C=200A$



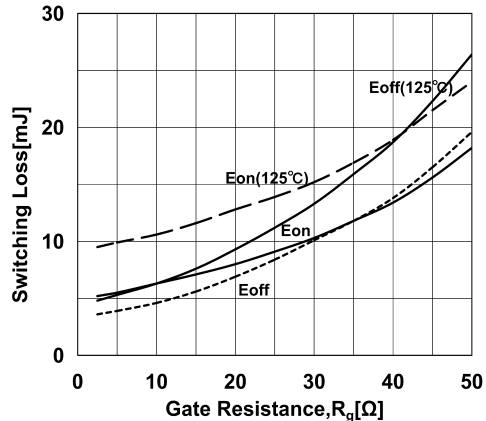
Switching Time vs. T_j
 $V_{ge}=15V, V_{CE}=200V, I_C=200A, R_g=4.7\Omega$



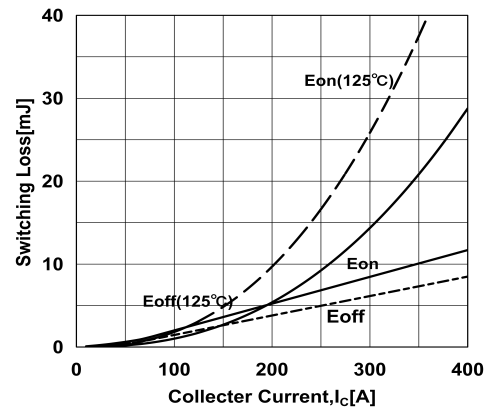
Switching Loss vs. T_j
 $V_{ge}=15V, V_{ce}=400V, I_C=200A, R_g=4.7\Omega$



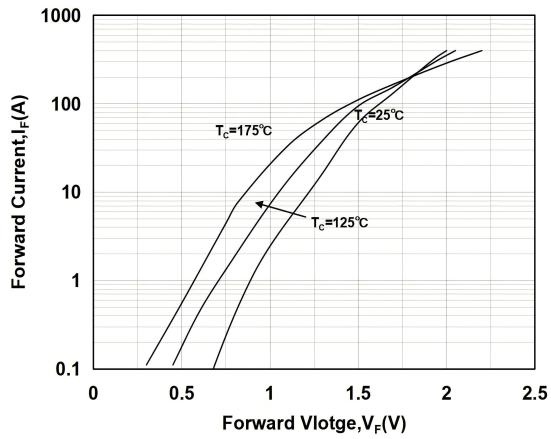
Switching Loss vs. R_g
 $V_{ce}=200V, V_{ge}=15V, I_C=200A$



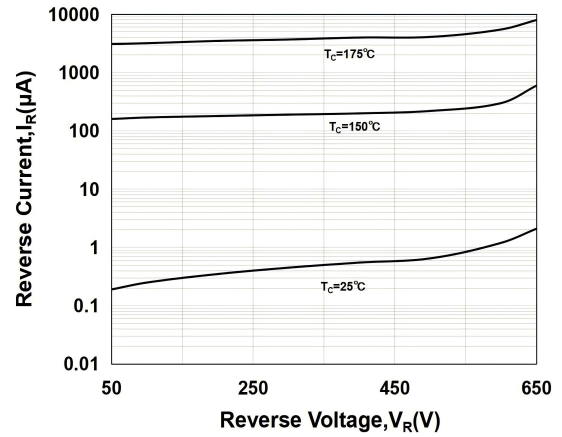
Switching Loss vs. I_c
 $V_{ce}=200V, V_{ge}=15V, R_g=4.7\Omega$



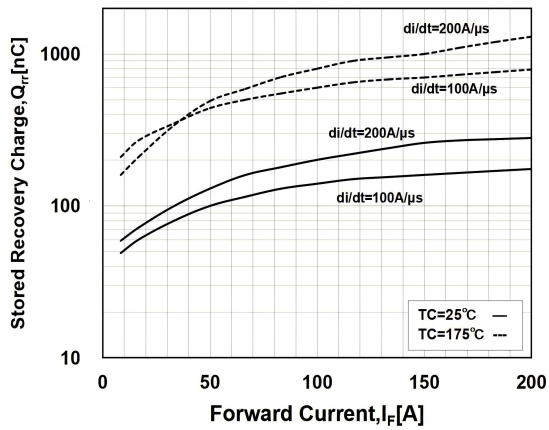
Forward Characteristics



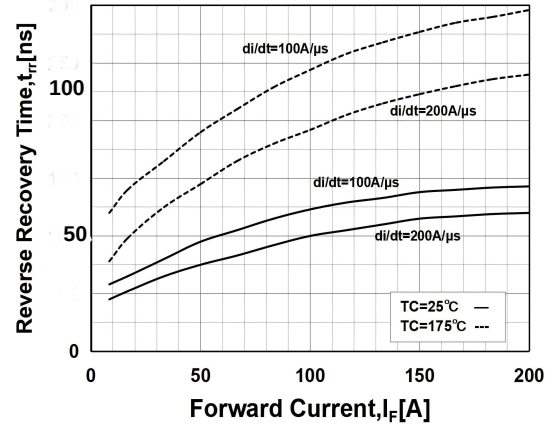
Reverse Current



Stored Charge



Reverse Recovery Time



Collector to Emitter Breakdown Voltage vs. Junction Temperature

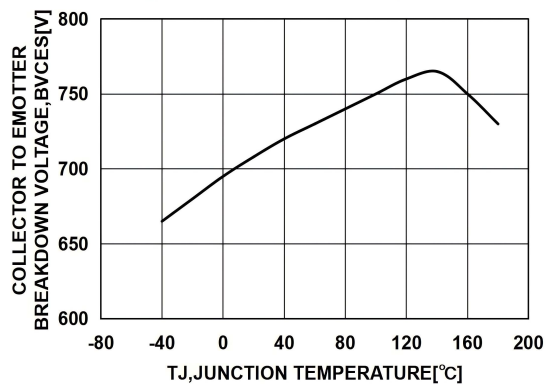
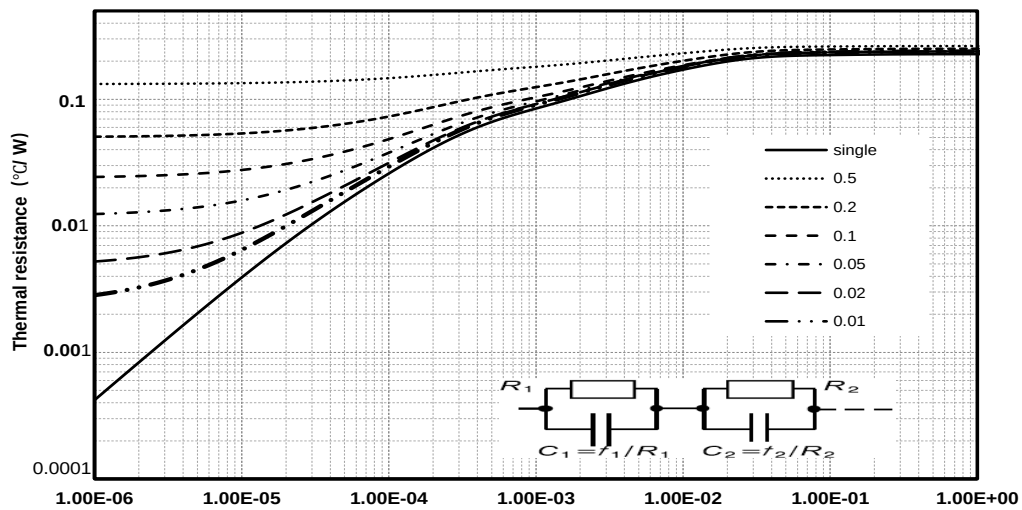
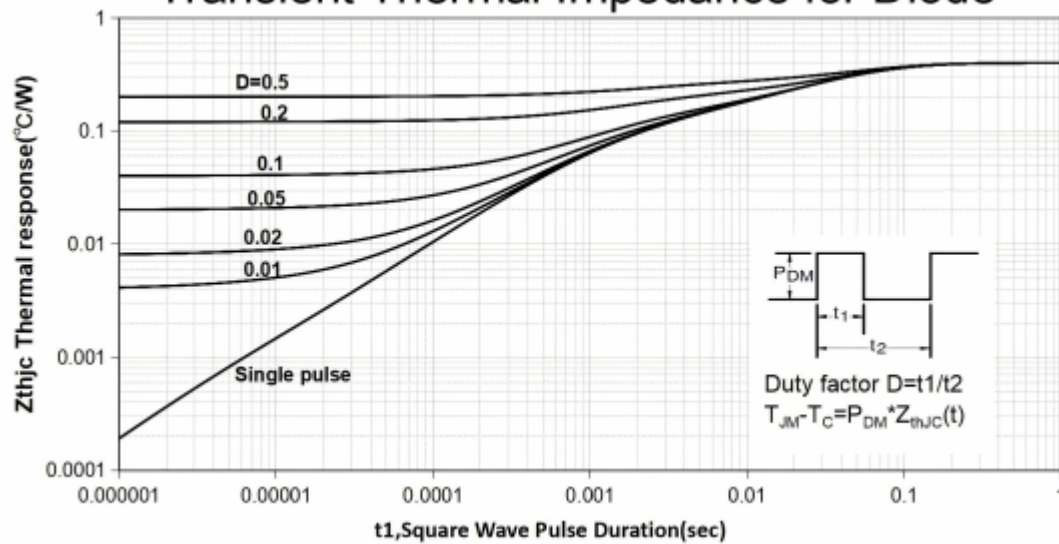


Fig 18. IGBT transient thermal resistance($D=tp/T$)



Transient Thermal Impedance for Diode



Pulse Duration (s)

Package Mechanical DATA

