

TP040K065WED

N-CHANNEL IGBT

MAIN CHARACTERISTICS

I_C	40A
V_{CES}	650V
$V_{cesat-typ}$ (@ $V_{ge}=15V$)	1.7V

APPLICATIONS

- General purpose inverters
- UPS

FEATURES

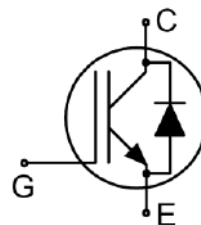
- Low gate charge
- Trench FS Technology,
- Saturation voltage:
 $V_{CE(sat)}$, typ = 1.7V@ $I_C = 40A$ and $T_C = 25^\circ C$
- RoHS product

ABSOLUTE RATINGS ($T_C=25^\circ C$)

Parameter	Symbol	Value	Unit
Collector-Emmitter Voltage	V_{CES}	650	V
Collector Current-continuous	I_C $T=25^\circ C$ $T=100^\circ C$	80	A
		40	A
Collector Current – pulse (note 1)	I_{CM}	120	A
Gate-Emmitter Voltage	V_{GES}	± 20	V
Turn-off safe area	-	120	A
Power Dissipation	P_D $T_C=25^\circ C$	284	W
Operating and Storage Temperature Range	T_J, T_{STG}	$-55 \sim +150$	$^\circ C$
Maximum Lead Temperature for Soldering Purposes	T_L	300	$^\circ C$

*Collector current limited by maximum junction temperature

Package



ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Off –Characteristics						
Collector-Emmitter Voltage	BV_{CES}	$I_C=250\mu A, V_{GE}=0V$	650	-	-	V
Breakdown Voltage Temperature Coefficient	$\Delta BV_{CES}/\Delta T_J$	$I_C=0.5mA$, referenced to $25^\circ C$	-	0.6	-	$V/^\circ C$
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_C=25^\circ C$	-	-	0.2	mA
Gate-body leakage current, forward	I_{GESF}	$V_{CE}=0V, V_{GE}=20V$	-	-	200	nA
Gate-body leakage current, reverse	I_{GESR}	$V_{CE}=0V, V_{GE}=-20V$	-	-	-200	nA
On-Characteristics						
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	5.1	-	6.9	V
Collector-Emmitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_C=40A, T_C=25^\circ C$	-	1.7	2.4	V
Dynamic Characteristics						
Input capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1.0MHz$	-	2440	-	pF
Output capacitance	C_{oes}		-	193	-	pF
Reverse transfer capacitance	C_{res}		-	64.5	-	pF
Total Gate Charge	Q_g	$V_{CC}=520V, I_C=40A, R_G=7.9\Omega, V_{GE}=15V, T_C=25^\circ C$	-	75.3	-	nC
Gate to emitter charge	Q_{ge}		-	25.9	-	
Gate to collector charge	Q_{gc}		-	30.3	-	
Gate resistance	R_g	$f=1 MHz$, open collector	-	1.3	-	Ω
short current	I_{sc}	$V_{GE}=15V, V_{CE}=400V, t_{sc} < 5\mu s$	-	175	-	A

ELECTRICAL CHARACTERISTICS

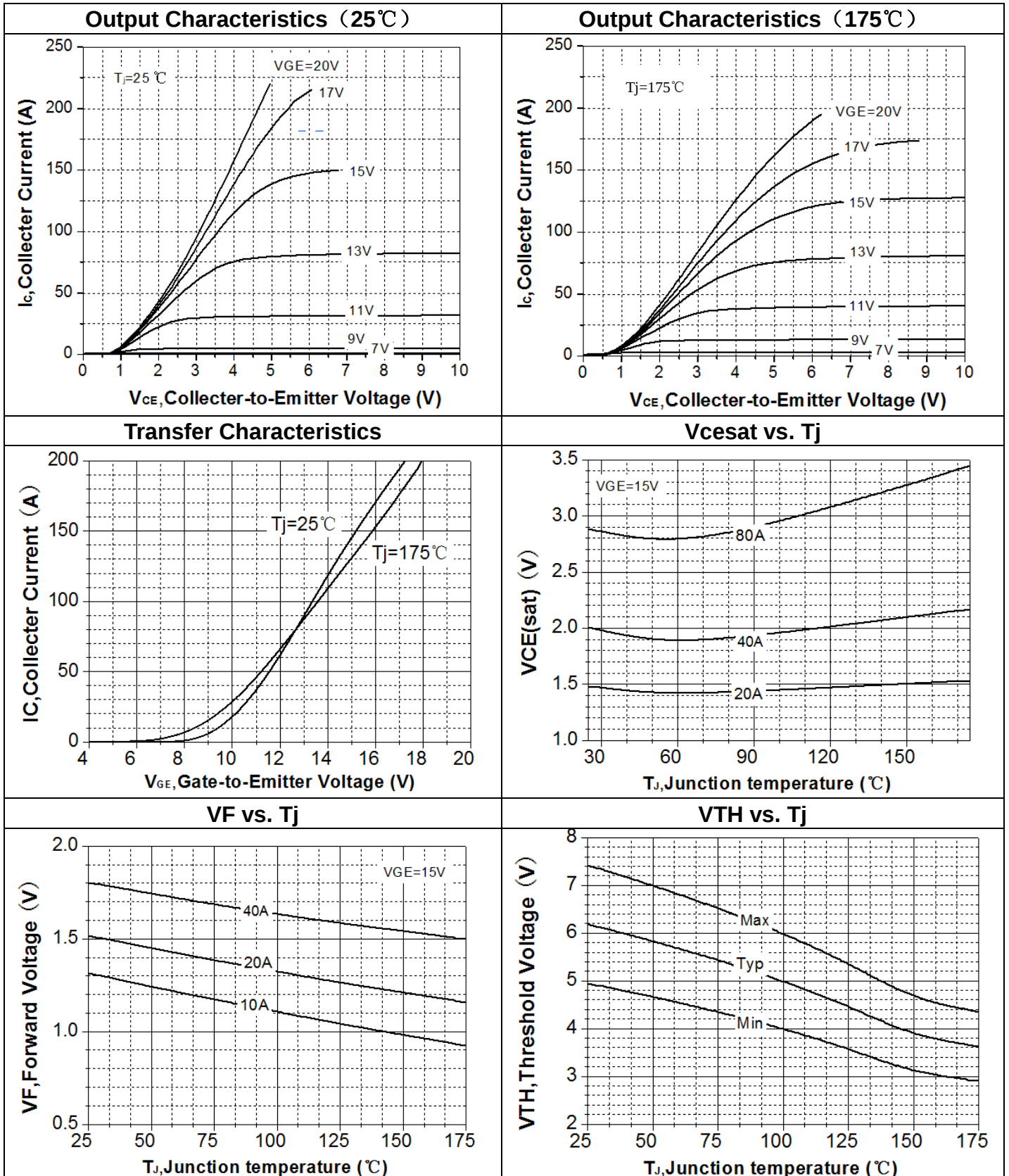
Switching Characteristics						
Parameter	Symbol	Tests conditions	Min	Typ	Max	Units
Turn-On delay time	t _d (on)	V _{CC} =400V,I _c =40A,R _G =7.9Ω V _{GE} =15 V T _C =25°C	-	38.2	-	ns
Turn-On rise time	t _r		-	65.8	-	ns
Turn-Off delay time	t _d (off)		-	100	-	ns
Turn-Off Fall time	t _f		-	35.0	-	ns
Turn-On energy	Eon		-	0.83	-	mJ
Turn-off energy	Eoff		-	0.29	-	mJ
Total switching energy	Etot		-	1.12	-	mJ
Anti-Parallel Diode Characteristics and Maximum Ratings						
Drain-Source Diode Forward Voltage	V _F	V _{GE} =0V, I _S =20A	-	1.5	2.5	V
Diode Reverse recovery time	t _{rr}	V _{GE} =0V, V _R =400V I _F =40A dI _F /dt=100A/μs (note 4) T _C =25°C	-	36.6	-	ns
Diode Reverse recovery charge	Q _{rr}		-	17.5	-	nC
Diode Reverse recovery Current	I _{RRM}		-	0.87	-	A
Diode Reverse recovery time	t _{rr}	V _{GE} =0V, V _R =400V I _F =40A dI _F /dt=100A/μs (note 4) T _C =175°C	-	288	-	ns
Diode Reverse recovery charge	Q _{rr}		-	657	-	nC
Diode Reverse recovery Current	I _{RRM}		-	3.96	-	A

Parameter	Symbol	Typ	Unit
		TJT040K065WED	
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	0.44	$^\circ C/W$
Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	40	$^\circ C/W$

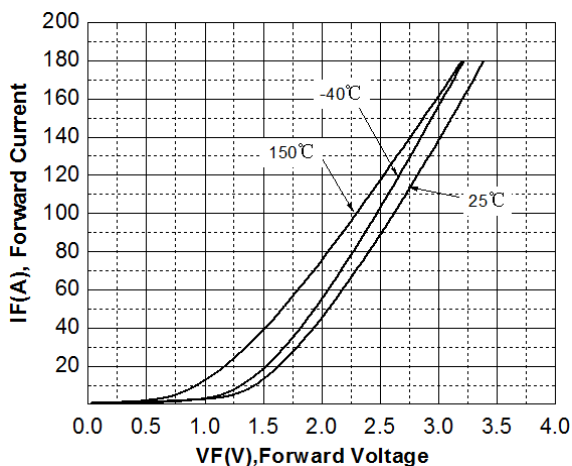
Notes:

- 1: Pulse width limited by maximum junction temperature
- 2: Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$
- 3: Essentially independent of operating temperature

ELECTRICAL CHARACTERISTICS (curves)

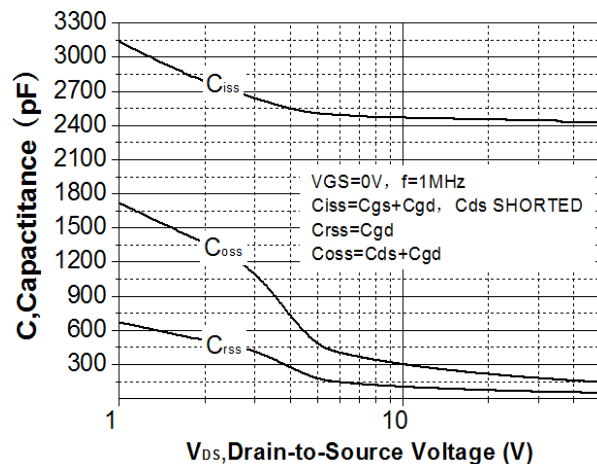


Diode Characteristic



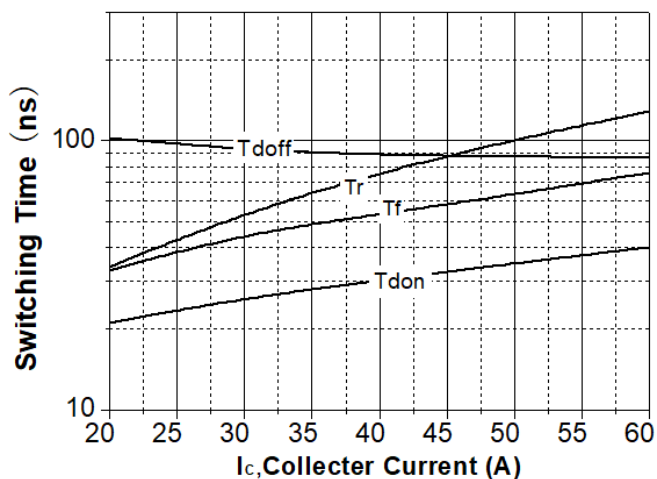
Capacitance Characteristic

$V_{ce}=25\text{V}, V_{GE}=0\text{V}, f=1.0\text{MHz}$



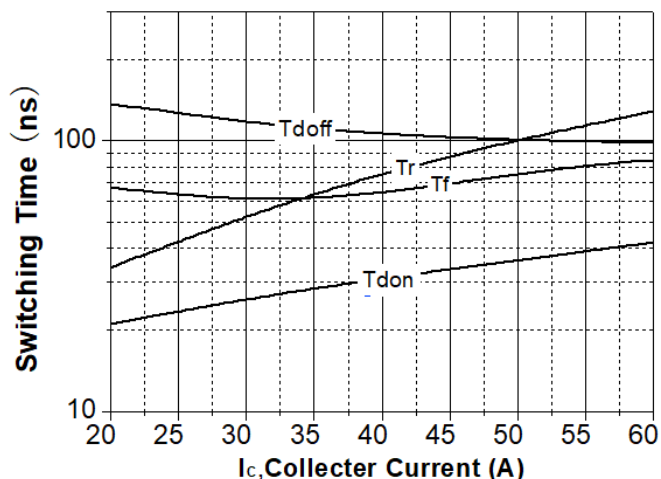
Switching Time vs. I_C (25°C)

$V_{CE}=400\text{V}, V_{GE}=15\text{V}, R_G=7.9\Omega$



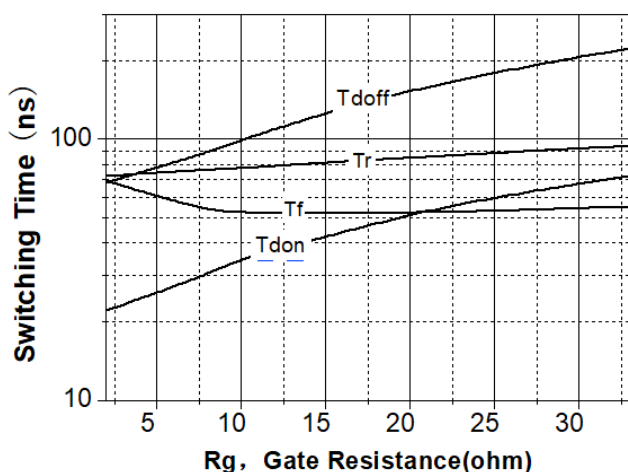
Switching Time vs. I_C (175°C)

$V_{CE}=400\text{V}, V_{GE}=15\text{V}, R_G=7.9\Omega$



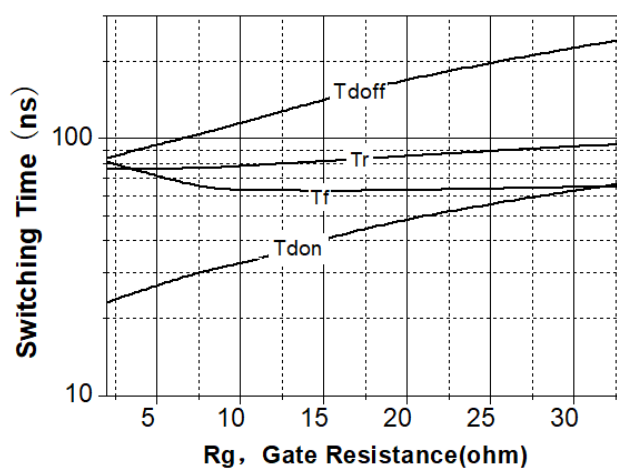
Switching Time vs. R_g (25°C)

$V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C:40\text{A}$



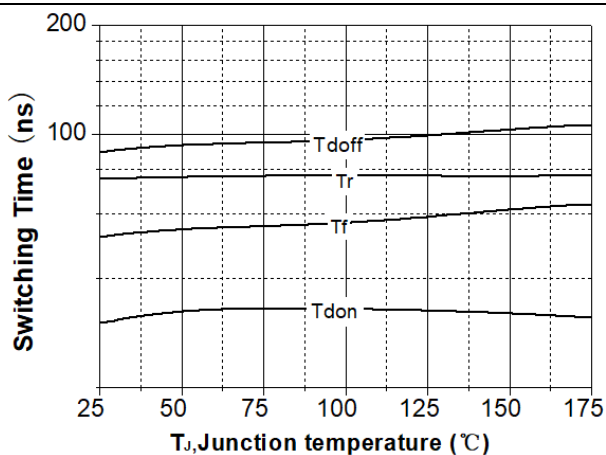
Switching Time vs. R_g (175°C)

$V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C:40\text{A}$



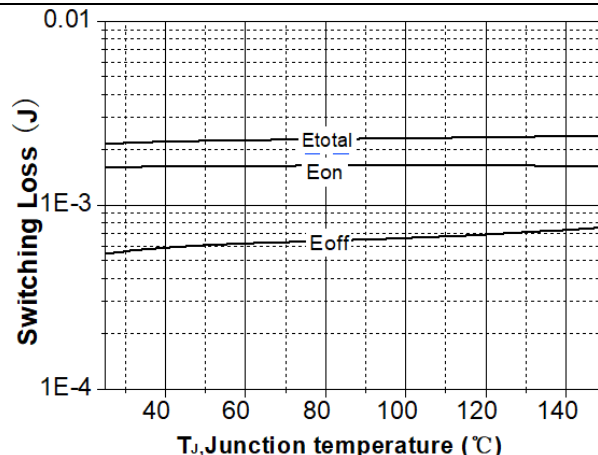
Switching Time vs. Tj

VGE=15V, VCE=400V, IC:40A, Rg=7.9Ω



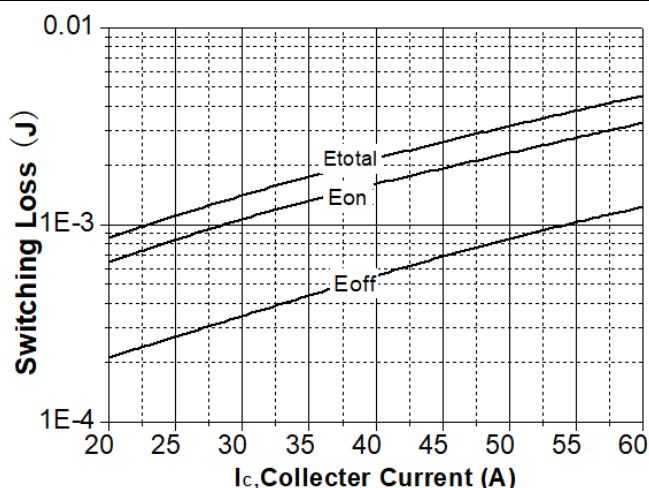
Switching Loss vs. Tj

VGE=15V, VCE=400V, IC:40A, Rg=7.9Ω



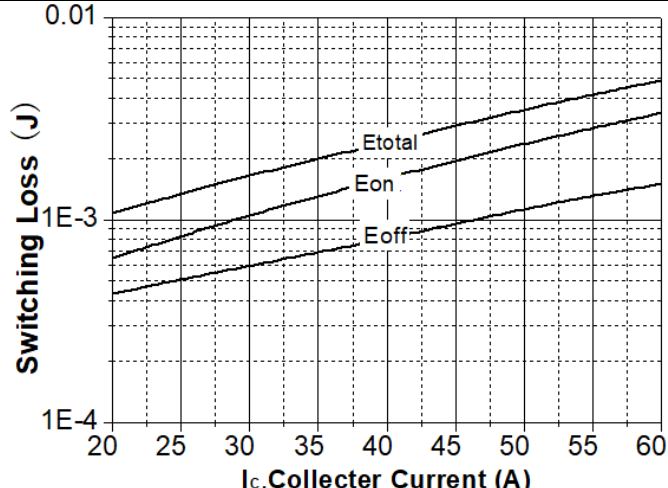
Switching Loss vs. IC(25°C)

VGE=15V, VCE=400V, Rg=7.9Ω



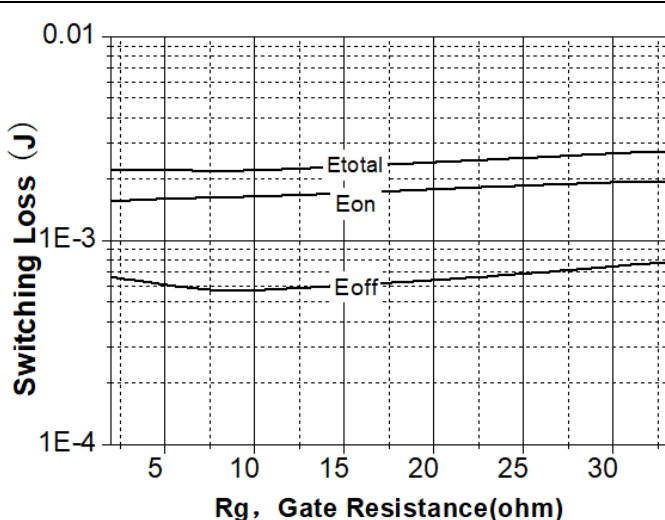
Switching Loss vs. IC(175°C)

VGE=15V, VCE=400V, Rg=7.9Ω



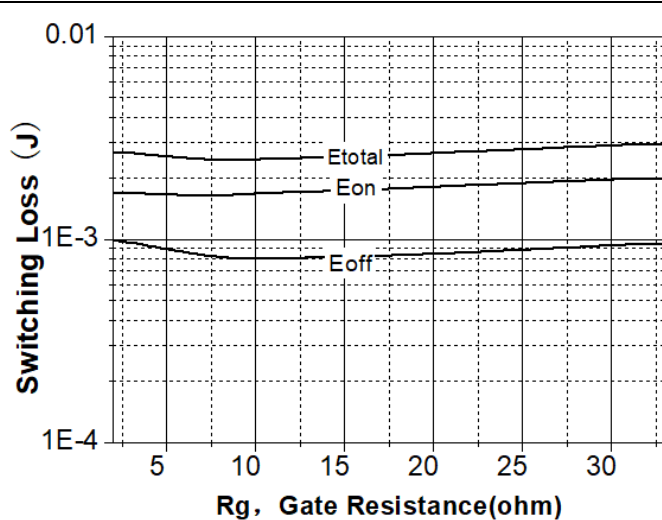
Switching Loss vs. Rg(25°C)

VGE=15V, VCE=400V, IC:40A

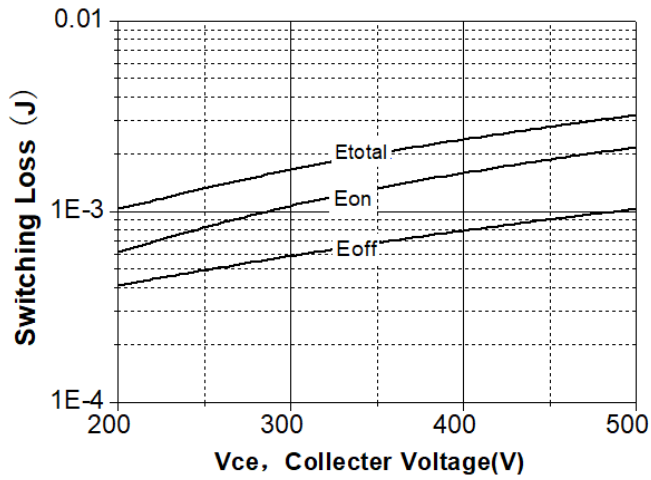


Switching Loss vs. Rg(175°C)

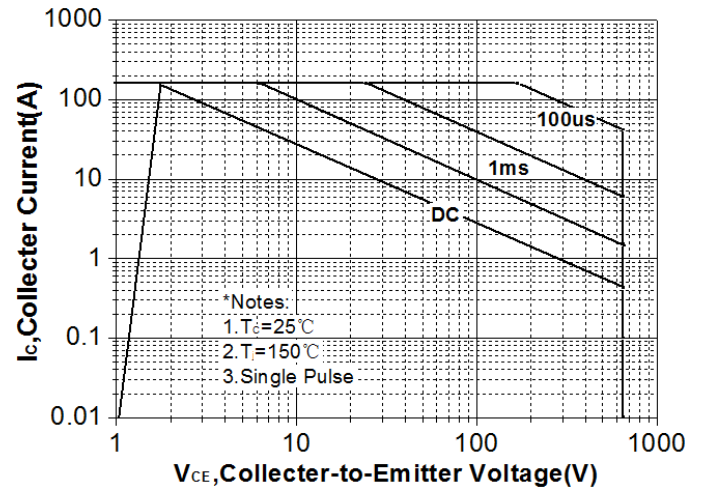
VGE=15V, VCE=400V, IC:40A



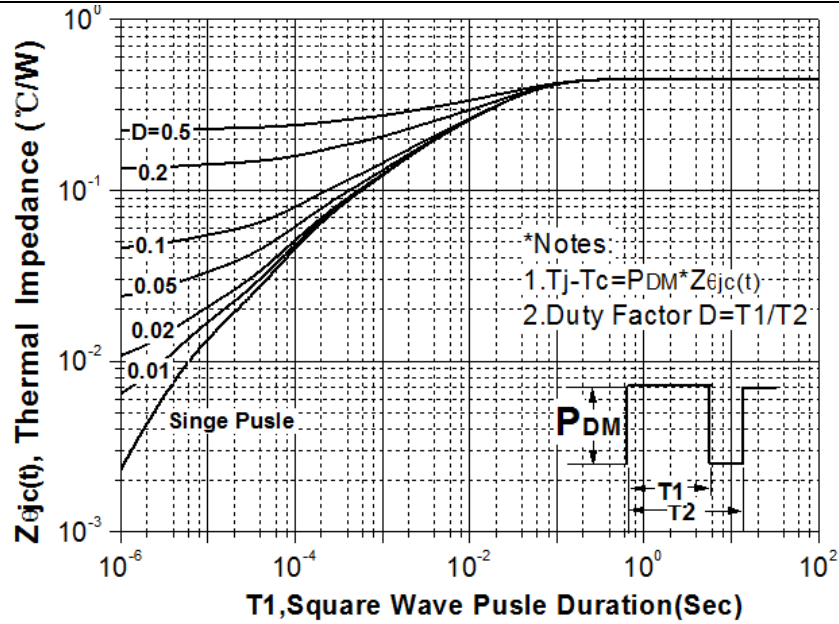
Switching Loss vs. VCE(175°C)



Forward Bias SOA



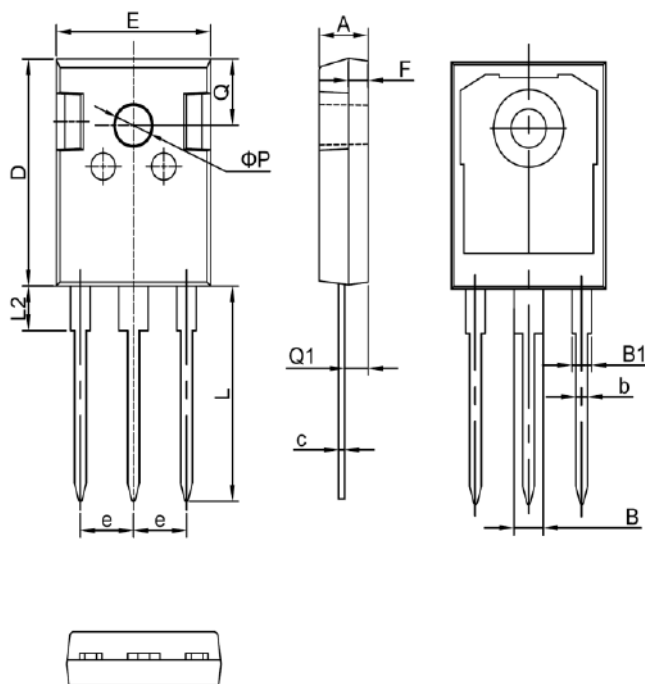
Transient Thermal Impedance for IGBT



PACKAGE MECHANICAL DATA

TO-247

Unit : mm



符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70