



TT040U060EQ

主要参数 MAIN CHARACTERISTICS

I_C	40 A
V_{CES}	600V
$V_{cesat-typ}(V_{ge}=15V)$	1.8V

用途

- 焊接
- PFC

APPLICATIONS

- Welding converters
- Power Factor Correction

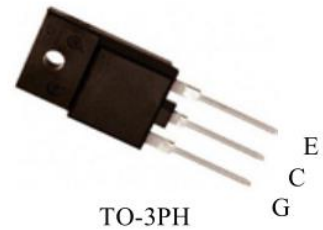
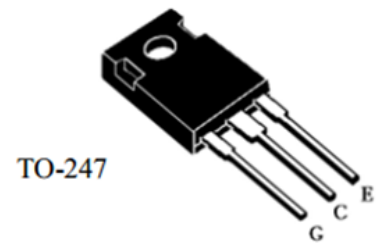
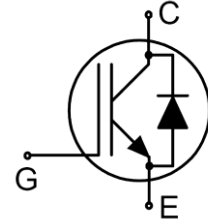
产品特性

- 低栅极电荷
- Trench FS 技术
- RoHS 产品

FEATURES

- Low gate charge
- Trench FS Technology
- RoHS product

封装 Package



订货信息 ORDER MESSAGE

订货型号 Order codes				印 记 Marking	封 装 Package
有卤-条管 Halogen-Tube	无卤-条管 Halogen-Free-Tube	有卤-编带 Halogen-Reel	无卤-编带 Halogen-Free-Reel		
TT040U060EQ-GA-B	TT040U060EQ-GA-BR	N/A	N/A	TT040U060EQ	TO-3PH
TT040U060EQ-GE-B	TT040U060EQ-GE-BR	N/A	N/A	TT040U060EQ	TO-247

绝对最大额定值 ABSOLUTE RATINGS (T_C=25℃)

项 目 Parameter	符 号 Symbol	数 值 Value		单 位 Unit
		TO-247	TO-3PH	
最高集电极-发射极直流电压 Collector-Emmitter Voltage	V _{CES}	600	600	V
*连续集电极电流 Collector Current-continuous	I _C	80(T _C =25℃)	80(T _C =25℃)	A
		40(T _C =100℃)	40(T _C =100℃)	A
最大脉冲集电极极电流 (注1) Collector Current – pulse (note 1)	I _{CM}	120	120	A
二极管正向测试电流 Diode RMS forward current	I _F	80(T _C =25℃)	80(T _C =25℃)	A
		40(T _C =100℃)	40(T _C =100℃)	A
二极管正向脉冲电流 Diode pulse current	I _{FSM}	120	120	A
最高栅极发射极电压 Gate-Emmitter Voltage	V _{GES}	±20	±20	V
Turn-off safe area	-	160	160	A
耗散功率 Power Dissipation	P _D T _C =25℃	304.8	96	W
存储温度 Storage Temperature Range	T _{STG}	-55~+150	-55~+150	℃
结温 Junction Temperature Range	T _J	-55~+150	-55~+150	℃
引线最高焊接温度 Maximum Lead Temperature for Soldering Purposes	T _L	300	300	℃

*连续集电极电流由最高结温限制

*Collector current limited by maximum junction temperature

注释:

1: 脉冲宽度由最高结温限制

Notes:

1: Pulse width limited by maximum junction temperature



电特性 ELECTRICAL CHARACTERISTICS

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
关态特性 Off –Characteristics						
集电极-发射极击穿电压 Collector-Emmitter Voltage	BV_{CES}	$I_C=250\mu A, V_{GE}=0V$	600	-	-	V
零栅压下集电极漏电流 Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=600V, V_{GE}=0V, T_C=25^\circ C$	-	-	40	μA
正向栅极体漏电流 Gate-body leakage current, forward	I_{GESF}	$V_{CE}=0V, V_{GE}=20V$	-	-	200	nA
反向栅极体漏电流 Gate-body leakage current, reverse	I_{GESR}	$V_{CE}=0V, V_{GE}=-20V$	-	-	-200	nA
通态特性 On-Characteristics						
阈值电压 Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C=250\mu A$	4	-	6	V
饱和压降 Collector-Emmitter saturation Voltage	V_{CESAT}	$V_{GE}=15V, I_C=40A$ $T_C=25^\circ C$ $T_C=175^\circ C$	- -	1.8 2.0	2.4 -	V
动态特性 Dynamic Characteristics						
输入电容 Input capacitance	C_{ies}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1.0MHz$	-	2173	-	pF
输出电容 Output capacitance	C_{oes}		-	218	-	pF
反向传输电容 Reverse transfer capacitance	C_{res}		-	72	-	pF
栅极电荷总量 Total Gate Charge	Q_g		-	85.8	-	nC
栅极-发射极 Gate to emitter charge	Q_{ge}	$V_{CC}=480V, I_C=40A, R_G=10\Omega, V_{GE}=15V$ $T_C=25^\circ C$	-	19.8	-	
栅极-集电极 Gate to collector charge	Q_{gc}		-	34.1	-	
栅极电阻-Gate resistance	R_g	$f=1MHz, \text{open collector}$	-	0.55	-	Ω





电特性 ELECTRICAL CHARACTERISTICS

开关特性 Switching Characteristics

项 目 Parameter	符 号 Symbol	测试条件 Tests conditions	最小 Min	典型 Typ	最大 Max	单位 Units
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=40A, R_G=10\Omega$ $V_{GE}=15V$ $T_C=25^\circ C$	-	12	-	ns
上升时间 Turn-On rise time	t_r		-	56	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	92	-	ns
下降时间 Turn-Off Fall time	t_f		-	68	-	ns
开通损耗 Turn-On energy	E_{on}		-	0.71	-	mJ
关断损耗 Turn-off energy	E_{off}		-	0.89	-	mJ
总开关损耗 Total switching energy	E_{tot}		-	1.60	-	mJ
开启延迟时间 Turn-On delay time	$t_{d(on)}$	$V_{CC}=400V, I_c=40A, R_G=10\Omega$ $V_{GE}=15V$ $T_C=175^\circ C$	-	14	-	ns
上升时间 Turn-On rise time	t_r		-	58	-	ns
关断延迟时间 Turn-Off delay time	$t_{d(off)}$		-	112	-	ns
下降时间 Turn-Off Fall time	t_f		-	102	-	ns
开通损耗 Turn-On energy	E_{on}		-	0.72	-	mJ
关断损耗 Turn-off energy	E_{off}		-	1.21	-	mJ
总开关损耗 Total switching energy	E_{tot}		-	1.93	-	mJ

反并联二极管特性及最大额定值 Anti-Parallel Diode Characteristics and Maximum Ratings

正向压降 Drain-Source Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=20A, T_C=25^\circ C$	-	1.5	2.5	V
		$V_{GE}=0V, I_F=20A, T_C=175^\circ C$	-	1.15	-	V
反向恢复时间 Diode Reverse recovery time	t_{rr}	$V_{GE}=0V, V_R=400V, I_F=15A$	-	36	-	ns
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}	$dl_F/dt=1000A/\mu s$	-	0.3	-	μC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}	$T_C=25^\circ C$	-	10	-	A
反向恢复时间 Diode Reverse recovery time	t_{rr}	$V_{GE}=0V, V_R=400V, I_F=15A$	-	116	-	ns
反向恢复电荷 Diode Reverse recovery charge	Q_{rr}	$dl_F/dt=1000A/\mu s$	-	1.1	-	μC
反向恢复电流 Diode Reverse recovery Current	I_{RRM}	$T_C=175^\circ C$	-	15.8	-	A

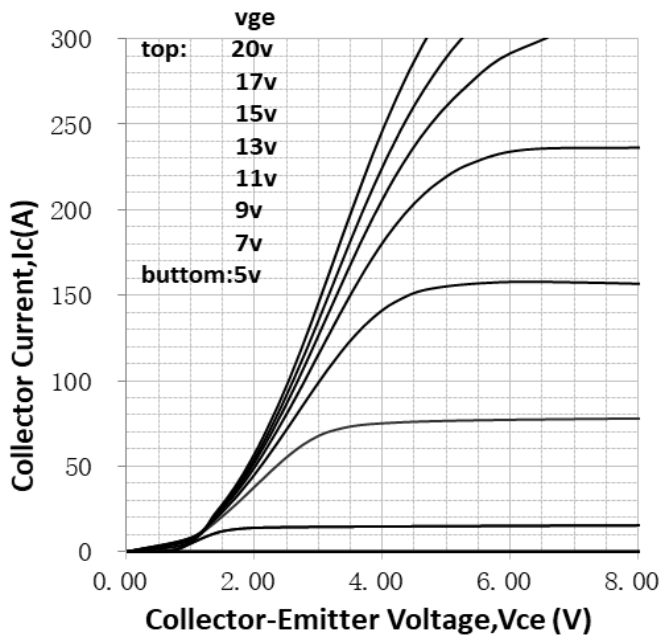
项 目 Parameter	符 号 Symbol	MAX		单 位 Unit
		TO-247	TO-3PH	
结到管壳的热阻 Thermal Resistance, Junction to Case IGBT	$R_{th(j-c)}$	0.41	1.3	$^\circ C/W$
结到环境的热阻 Thermal Resistance, Junction to Ambient	$R_{th(j-A)}$	40	40	$^\circ C/W$



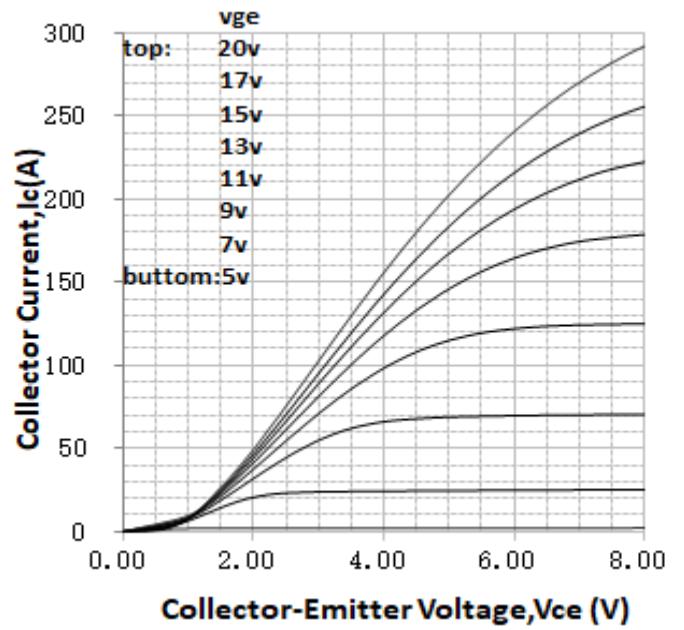


特征曲线 ELECTRICAL CHARACTERISTICS (curves)

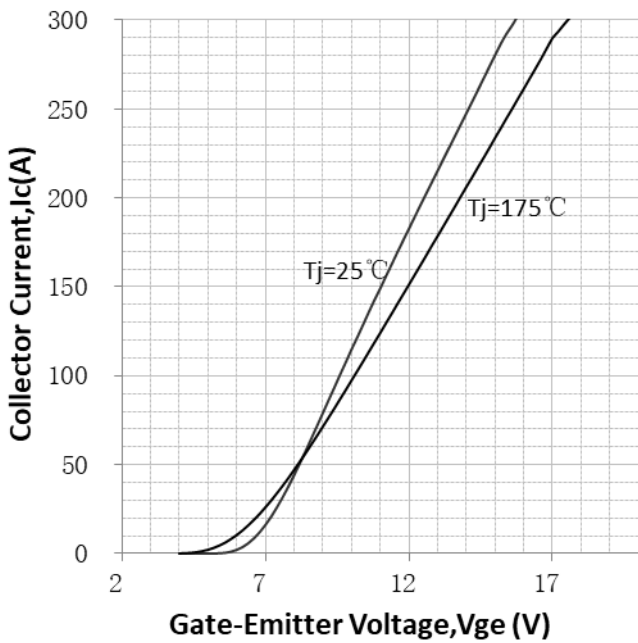
Output Characteristics (25°C)



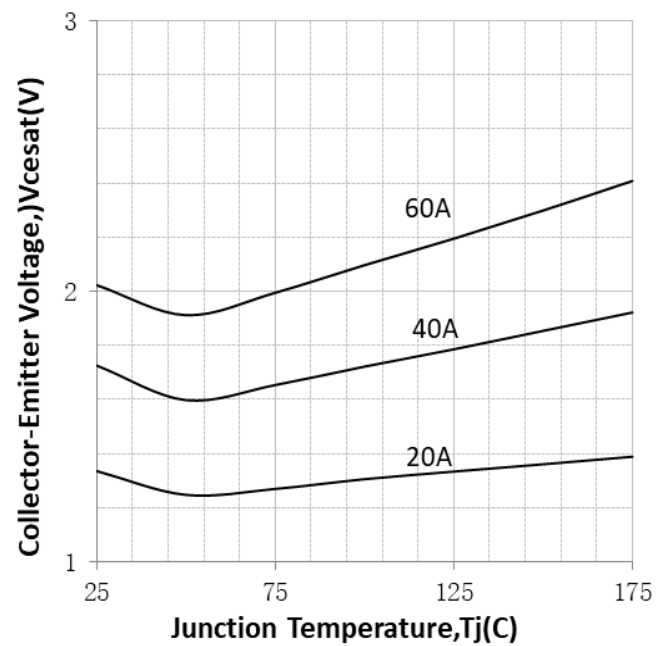
Output Characteristics (175°C)



Transfer Characteristics

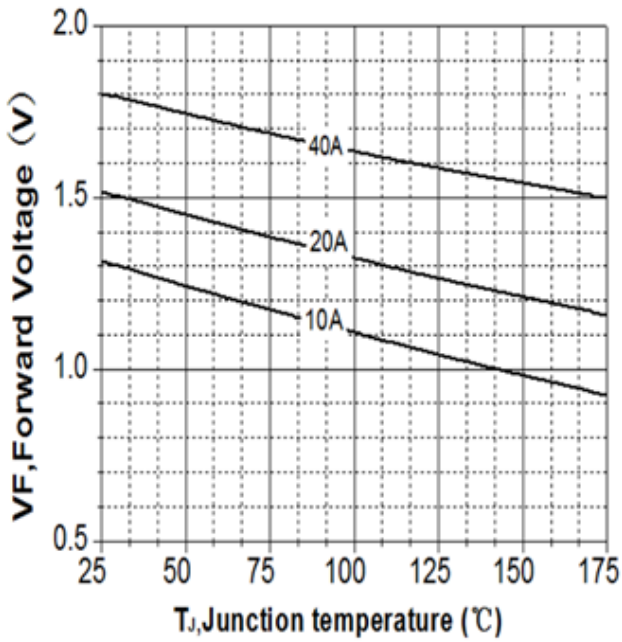


Vcesat vs. Tj

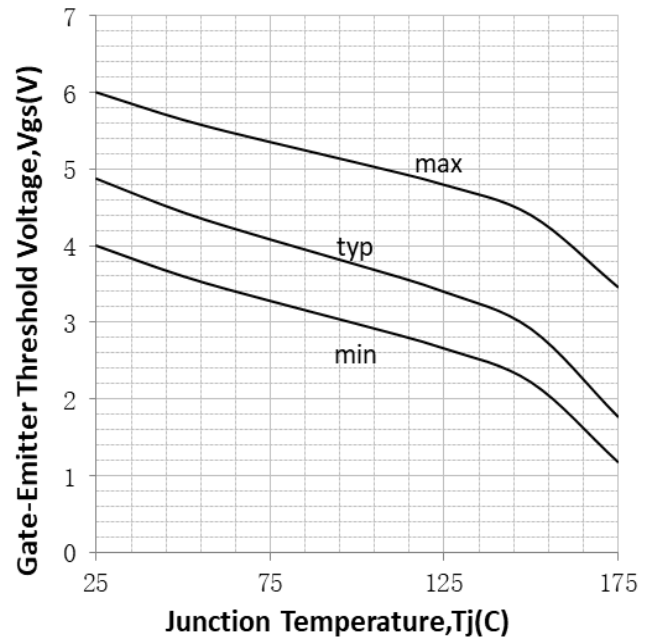




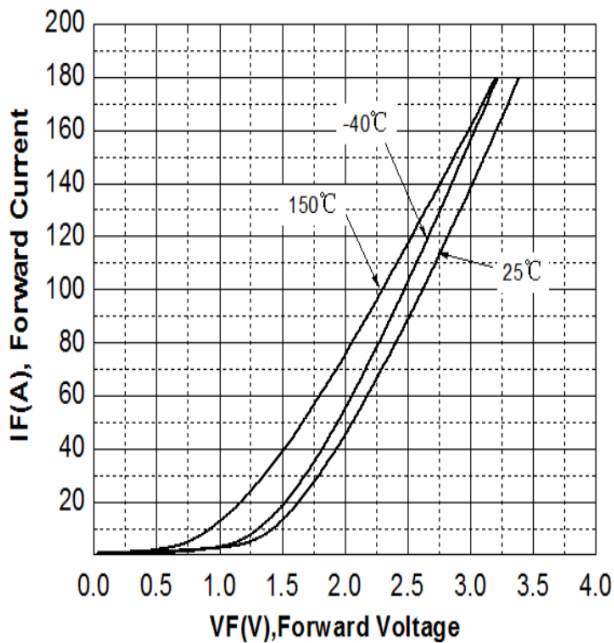
VF vs. Tj



VTH vs. Tj

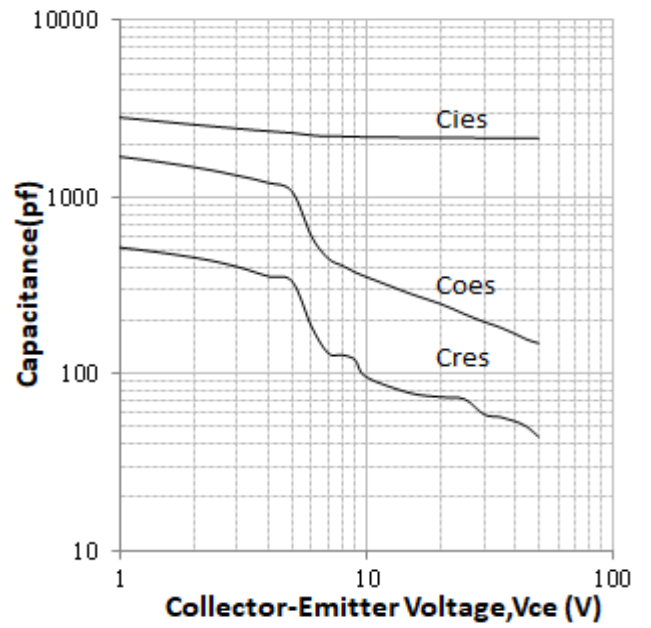


Diode Characteristic



Capacitance Characteristic

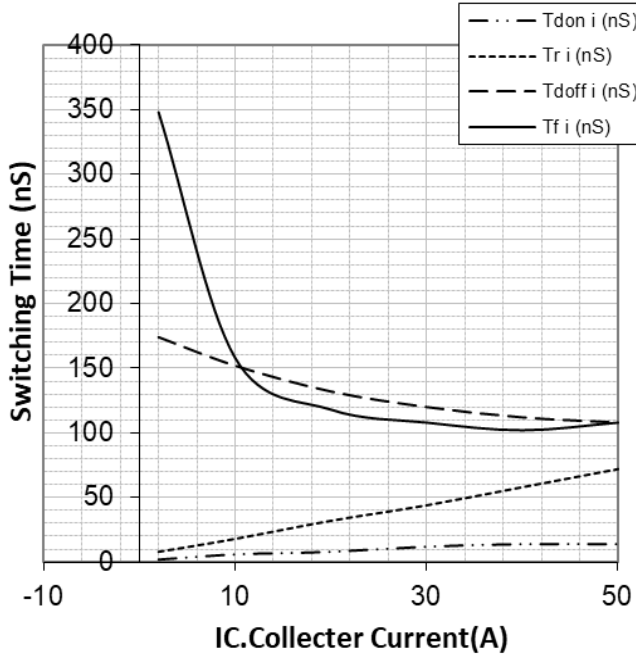
VGE = 0V, f = 1.0MHz





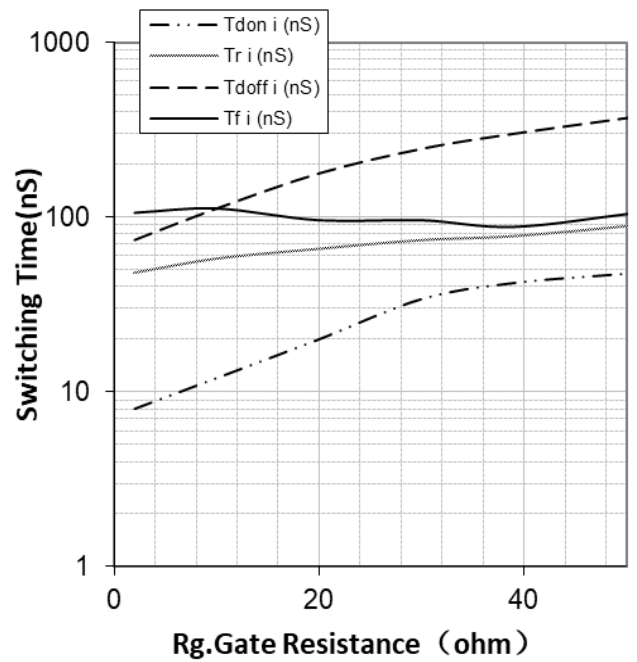
Switching Time vs. IC(175°C)

VGE=15V, VCE=400V, RG=10Ω



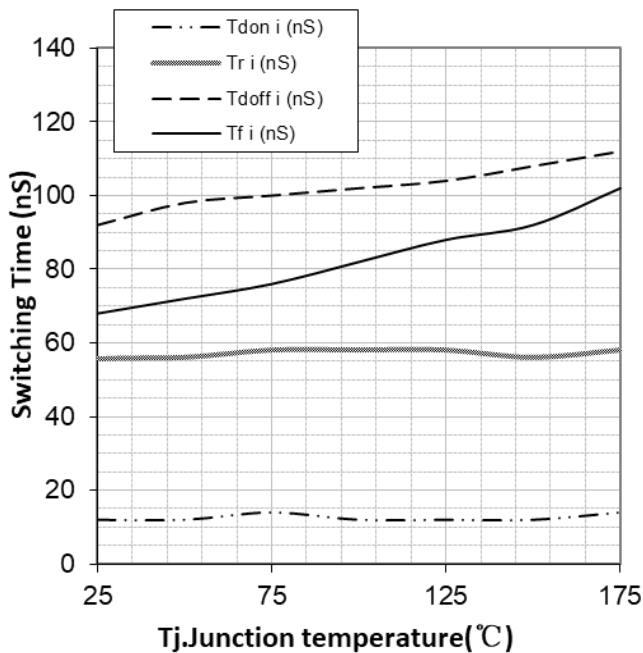
Switching Time vs. Rg(175°C)

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



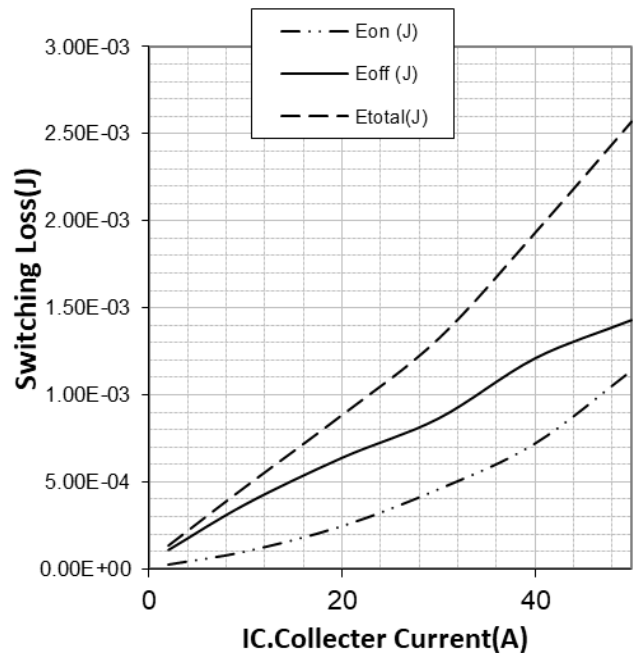
Switching Time vs. Tj

VGE=15V, VCE=400V, IC=40A, Rg=10Ω



Switching Loss vs. IC(175°C)

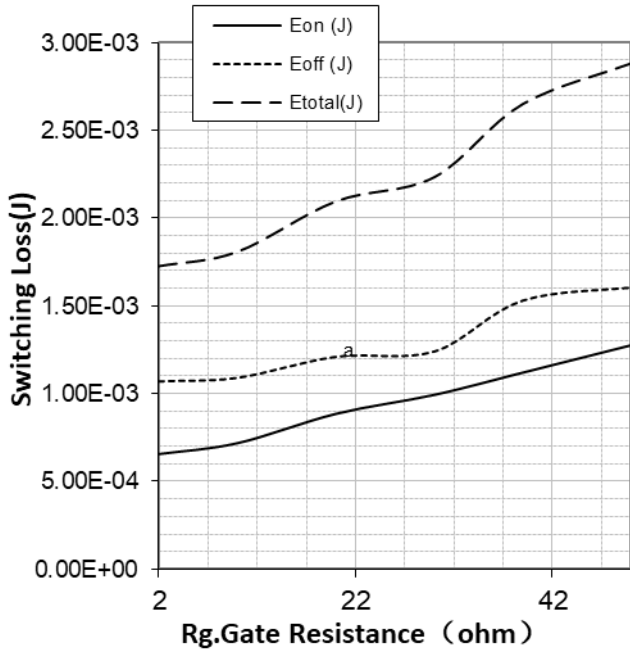
VGE=15V, VCE=400V, Rg=10Ω





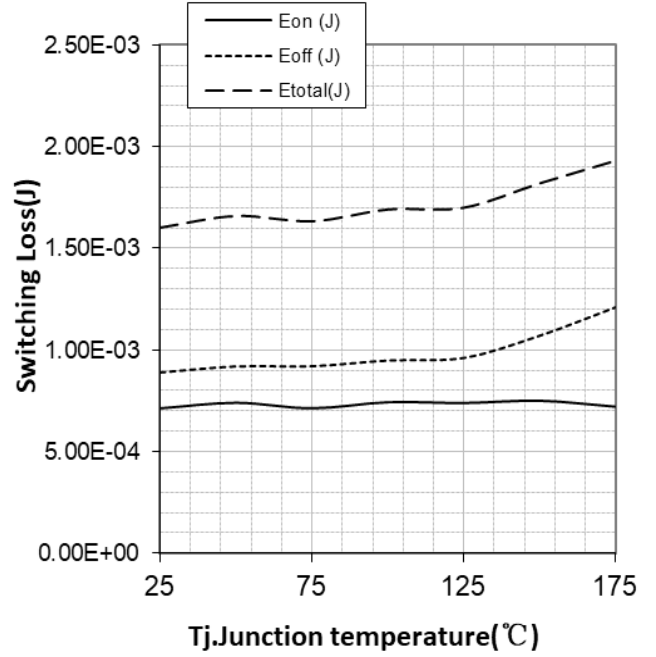
Switching Loss vs. Rg(175°C)

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

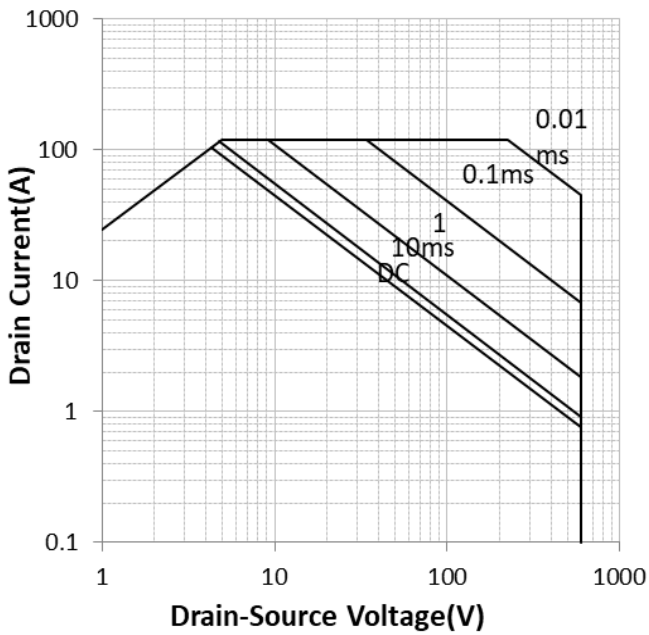


Switching Loss vs. Tj

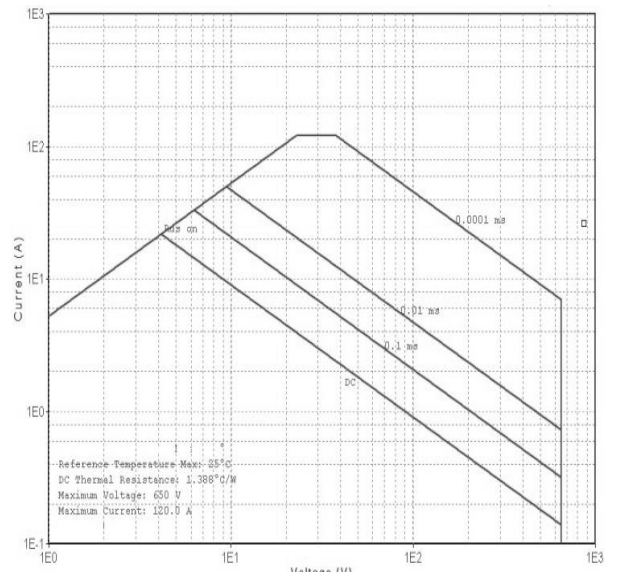
VGE=15V, VCE=400V, IC=40A, Rg=10Ω



Forward Bias SOA(TO-247)



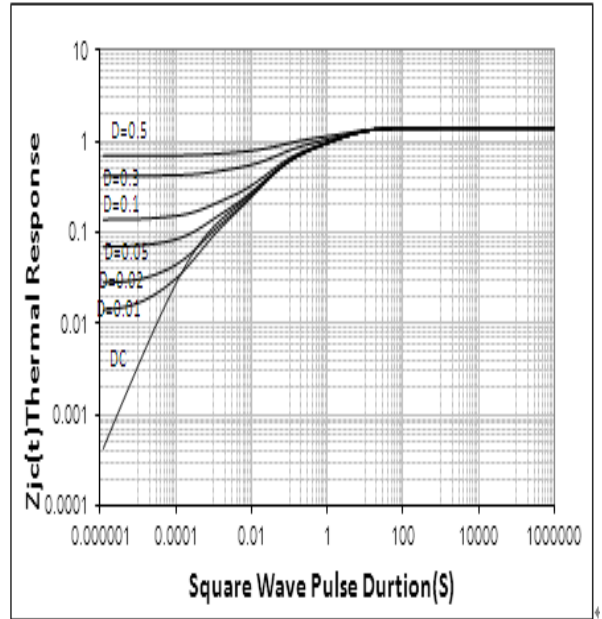
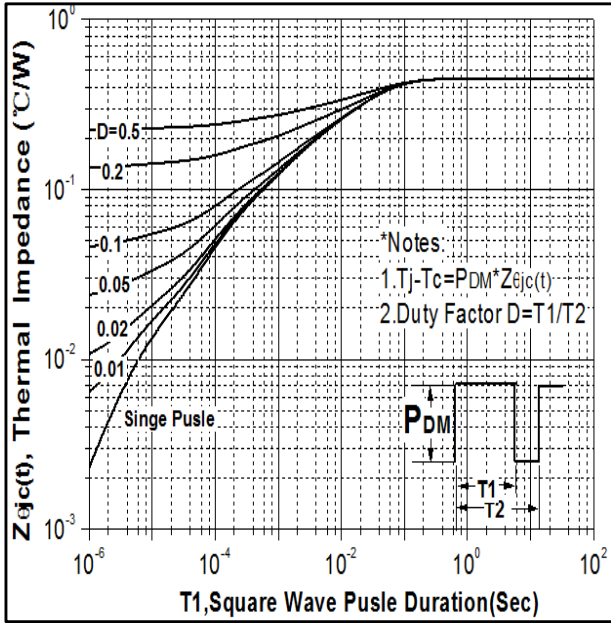
Forward Bias SOA(TO-3PH)





Transient Thermal Impedance for IGBT
(TO-247)

Transient Thermal Impedance for IGBT
(TO-3PH)

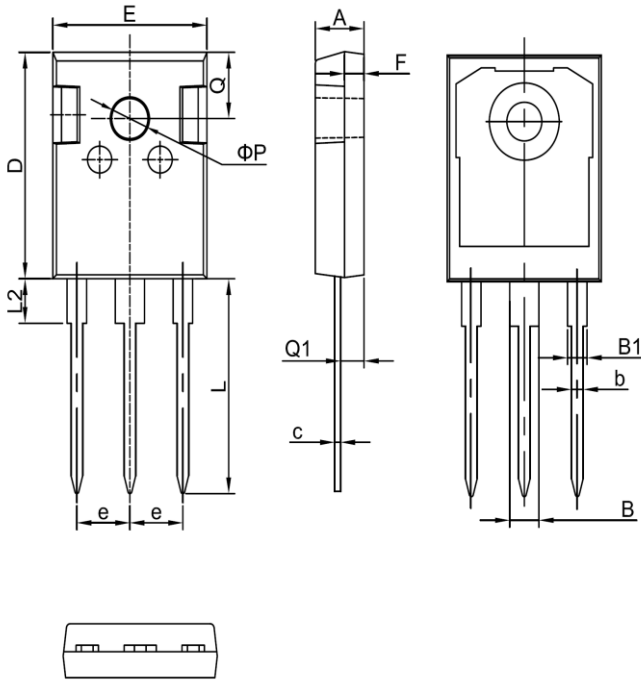




外形尺寸 PACKAGE MECHANICAL DATA

TO-247

单位 Unit : mm

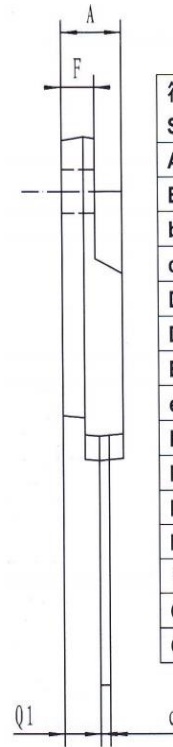
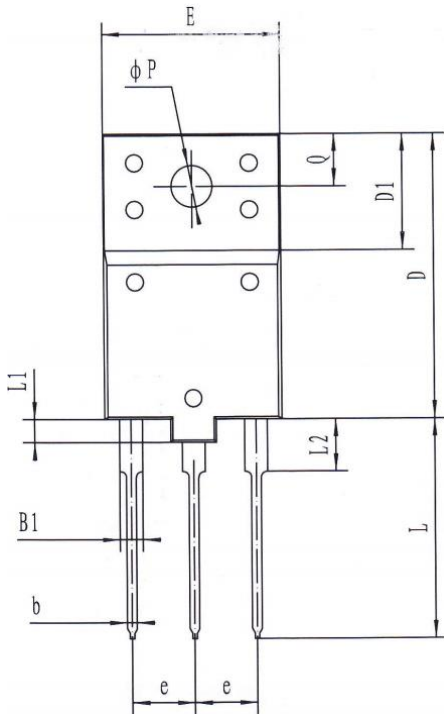


符号 symbol	MIN	MAX
A	4.90	5.10
B	2.95	3.35
B1	1.95	2.35
b	1.15	1.35
c	0.50	0.70
D	20.90	21.10
E	15.70	15.90
e	5.34	5.54
F	1.90	2.10
L	19.40	20.40
L2	4.03	4.23
Q	6.00	6.40
Q1	2.30	2.50
P	3.50	3.70



外形尺寸 PACKAGE MECHANICAL DATA

TO-3PH



符号 Symbol	Min	Max
A	5.2	5.8
B1	1.8	2.2
b	0.75	1.05
c	0.8	1.1
D	24.0	25.0
D1	9.8	10.2
E	15.0	16.0
e	5.45 (typ)	
F	2.7	3.3
L	18.5	19.5
L1	1.8	2.2
L2	4.3	4.7
ϕP	3.4	3.8
Q	4.3	4.7
Q1	3.1	3.5



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