

FGW40XS120C

Discrete IGBT

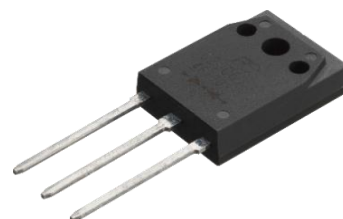
Discret IGBT (XS-series)
1200V/40A

■ Features

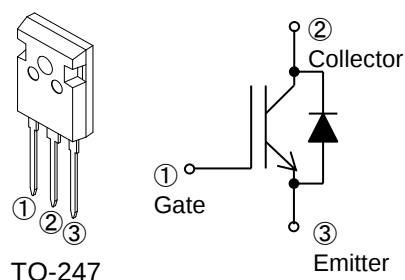
Pb-free lead terminal ;RoHS compliant
Helogen-free molding compound

■ Applications

Uninterruptible Power Supply, PV Power Conditioner,
Inverter welding machine



■ Equivalent Circuit



■ Maximum ratings and characteristics

● **Absolute maximum ratings at $T_{vj}=25^{\circ}\text{C}$ (unless otherwise specified)**

Parameter	Symbol	Value	Unit	Remarks
Collector-Emitter voltage	V_{CES}	1200	V	
Gate-Emitter voltage	V_{GES}	± 20	V	
Transient Gate-Emitter voltage		± 30	V	$t_p < 1 \mu\text{s}$
DC collector current	$I_{C@25}$	63	A	$T_C = 25^{\circ}\text{C}$
	$I_{C@100}$	40	A	$T_C = 100^{\circ}\text{C}$
Pulsed collector current	I_{CP}	160	A	Note*1
Turn-off safe operating area	-	160	A	$V_{CE} \leq 1200 \text{ V}, T_{vj} \leq 175^{\circ}\text{C}$
Diode forward current	$I_{C@25}$	63	A	
	$I_{C@100}$	40	A	
Diode pulsed current	I_{FP}	160	A	Note*1
IGBT max. power dissipation	P_{tot_IGBT}	351	W	$T_C = 25^{\circ}\text{C}$
FWD max. power dissipation	P_{tot_FWD}	127	W	$T_C = 25^{\circ}\text{C}$
Operating junction temperature	T_{vj}	$-40 \sim +175$	$^{\circ}\text{C}$	
Storage temperature	T_{stg}	$-55 \sim +175$	$^{\circ}\text{C}$	

Note*1 : Pulse width limited by T_{vjmax}

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● **Electrical characteristics (at $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Zero-gate voltage collector current	I_{CES}	$V_{CE}=1200\text{V}$ $V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	-	-	250	mA
		$T_{vj}=175^{\circ}\text{C}$	-	-	2	
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0\text{V}$ $V_{GE}=\pm 20\text{V}$	-	-	200	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE}=20\text{V}$ $I_C=40\text{mA}$	4.9	5.5	6.1	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15\text{V}$ $I_C=40\text{A}$ $T_{vj}=25^{\circ}\text{C}$	1.3	1.6	1.9	V
		$T_{vj}=125^{\circ}\text{C}$	-	2.05	-	
		$T_{vj}=175^{\circ}\text{C}$	-	2.15	-	
Input capacitance	C_{ies}	$V_{CE}=25\text{V}$	2350	4700	7050	pF
Ooutput capacitance	C_{oes}	$V_{GE}=0\text{V}$	33	66	100	
Reverse transfer capacitance	C_{res}	$f=1\text{MHz}$	19	38	60	
Gate charge	Q_G	$V_{CC}=600\text{V}, I_C=40\text{A}, V_{GE}=15\text{V}$	125	250	380	nC
Turn-on delay time	$t_{d(on)}$	$T_{vj}=25^{\circ}\text{C}, V_{CC}=600\text{V}, I_C=40\text{A}$	22	45	70	ns
Rise time	t_r	$V_{GE}=15\text{V}, R_G=10\Omega$	16	32	50	
Turn-off delay time	$t_{d(off)}$	Energy loss include "tail"	125	250	380	
Fall time	t_f	and FWD reverse recovery.	30	60	90	
Turn-on energy	E_{on}	$T_{vj}=25^{\circ}\text{C}, V_{CC}=600\text{V}, I_C=40\text{A}$ $V_{GE}=15\text{V}, R_G=10\Omega$ Energy loss include "tail" and FWD reverse recovery.	0.7	1.4	2.1	mJ
Turn-off energy	E_{off}		0.85	1.7	2.6	
Turn-on delay time	$t_{d(on)}$		22	44	66	ns
Rise time	t_r		13	26	39	
Turn-off delay time	$t_{d(off)}$		140	280	420	
Fall time	t_f		65	130	195	
Turn-on energy	E_{on}	$T_{vj}=175^{\circ}\text{C}, V_{CC}=600\text{V}, I_C=40\text{A}$ $V_{GE}=15\text{V}, R_G=10\Omega$ Energy loss include "tail" and FWD reverse recovery.	1.1	2.2	3.3	mJ
Turn-off energy	E_{off}		1.0	2.0	3.0	

※ Recommended external R_G value range is from 5.1Ω to 51Ω.

● **FWD characteristics**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward voltage drop	V_F	$I_F=40\text{A}$ $T_{vj}=25^{\circ}\text{C}$	2.5	2.9	3.3	V
		$T_{vj}=125^{\circ}\text{C}$	-	3.2	-	
		$T_{vj}=175^{\circ}\text{C}$	-	3.2	-	
Diode reverse recovery time	t_{rr}	$V_{CC}=600\text{V}, I_F=40\text{A}$	115	230	345	ns
Diode reverse recovery charge	Q_{rr}	$-di_F/dt=300\text{A}/\mu\text{s}, T_{vj}=25^{\circ}\text{C}$	0.55	1.10	1.65	μC
Diode reverse recovery time	t_{rr}	$V_{CC}=600\text{V}, I_F=40\text{A}$	250	500	750	ns
Diode reverse recovery charge	Q_{rr}	$-di_F/dt=300\text{A}/\mu\text{s}, T_{vj}=175^{\circ}\text{C}$	1.15	2.30	3.45	μC

■ **Thermal resistance**

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction-ambient	$R_{th(j-a)}$	-	-	50	$^{\circ}\text{C}/\text{W}$
Thermal resistance, IGBT junction to case	$R_{th(j-c)}_{IGBT}$	-	-	0.427	$^{\circ}\text{C}/\text{W}$
Thermal resistance, FWD junction to case	$R_{th(j-c)}_{FWD}$	-	-	1.176	$^{\circ}\text{C}/\text{W}$

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Figure 1. IGBT power dissipation vs T_c
 $T_{vj} \leq 175^\circ\text{C}$

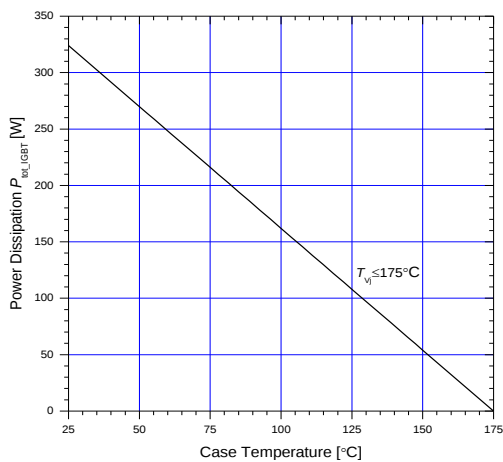


Figure 2. DC collector current vs T_c
 $V_{GE} \geq +15\text{ V}, T_{vj} \leq 175^\circ\text{C}$

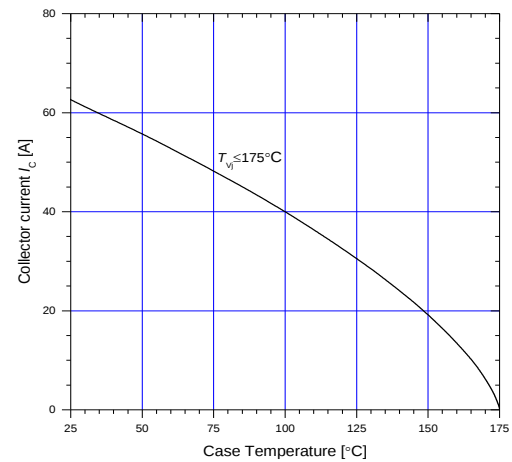


Figure 3. Typical output characteristics
 $T_{vj} = 25^\circ\text{C}$

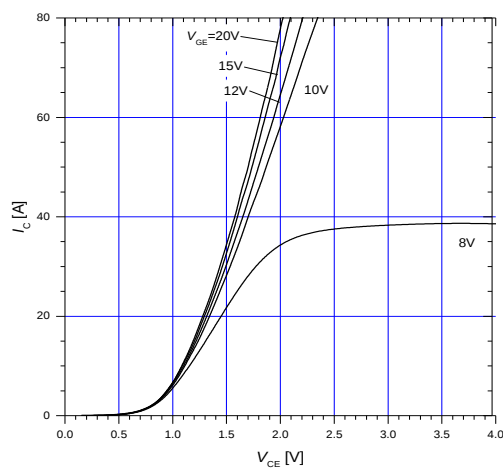


Figure 4. Typical output characteristics
 $T_{vj} = 175^\circ\text{C}$

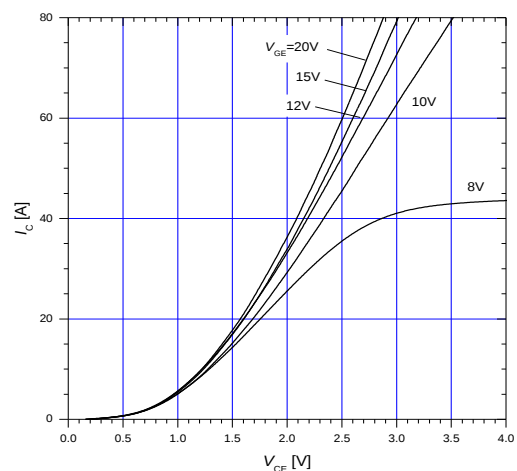


Figure 5. Typical transfer characteristics
 $V_{CE} = 20\text{ V}$

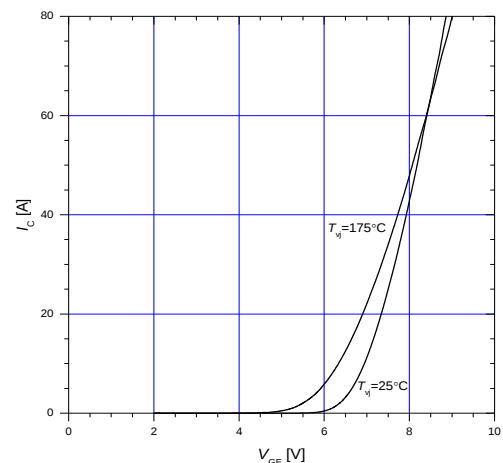
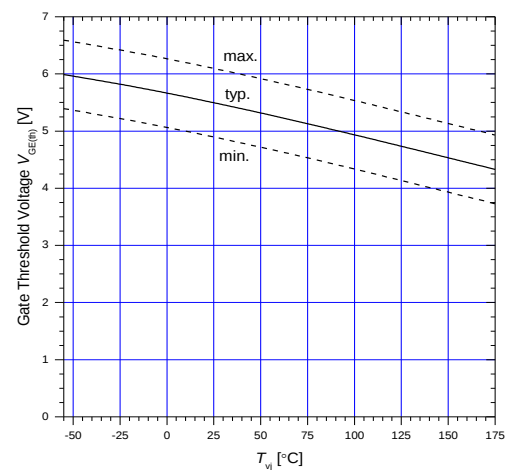


Figure 6. Gate threshold voltage
 $I_C = 40\text{ mA}, V_{CE} = 20\text{ V}$



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Figure 7. Typical capacitance

$V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$

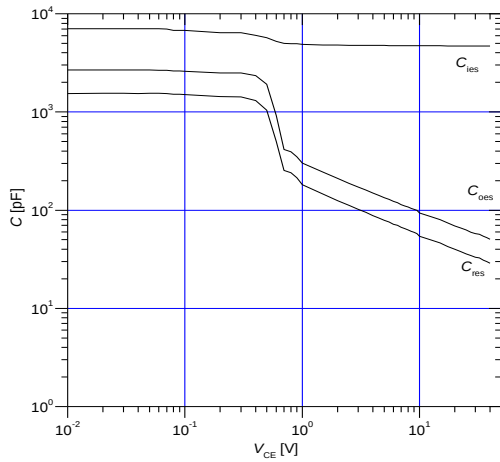


Figure 8. Typical gate charge

$I_C = 40 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 25^\circ\text{C}$

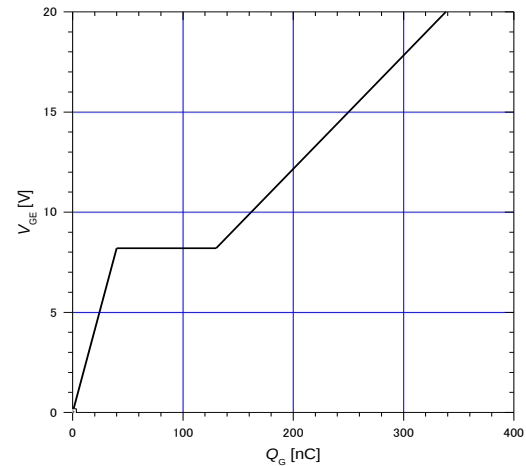


Figure 9. Typical switching times vs. I_C

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$, $T_{vj} = 175^\circ\text{C}$

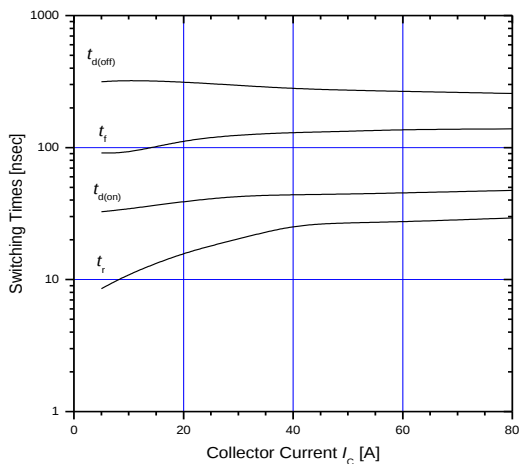


Figure 10. Typical switching times vs. R_G

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 40 \text{ A}$, $T_{vj} = 175^\circ\text{C}$

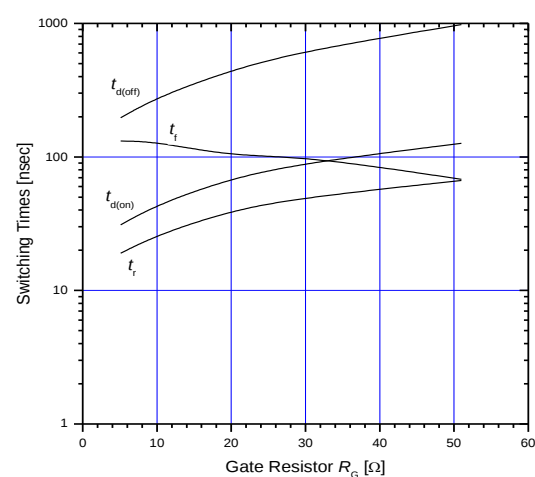


Figure 11. Typical switching losses vs. I_C

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$, $T_{vj} = 175^\circ\text{C}$

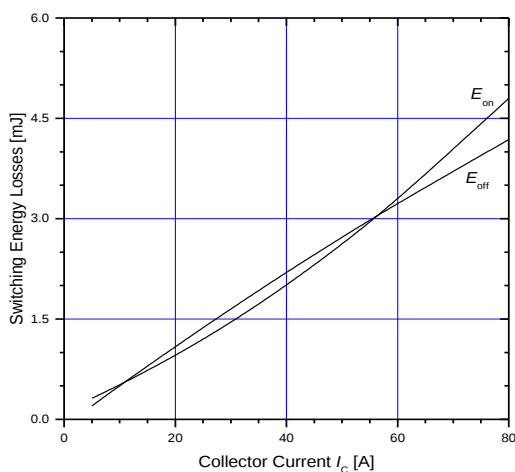
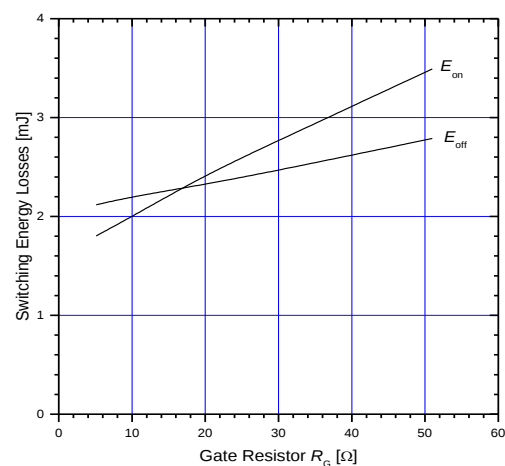


Figure 12. Typical switching losses vs. R_G

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 40 \text{ A}$, $T_{vj} = 175^\circ\text{C}$



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Figure 13. Typical forward characteristics of FWD

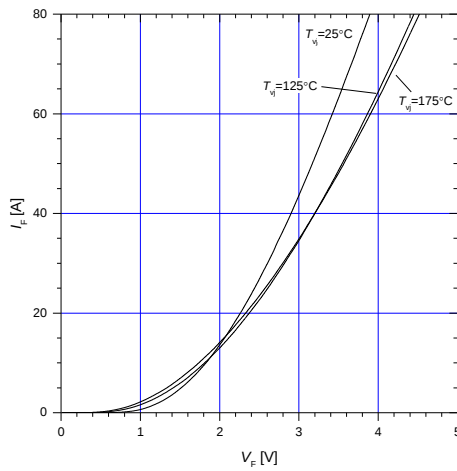


Figure 14.

Typical reverse recovery characteristics vs. I_F

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$, $T_{Vj} = 175^\circ \text{C}$

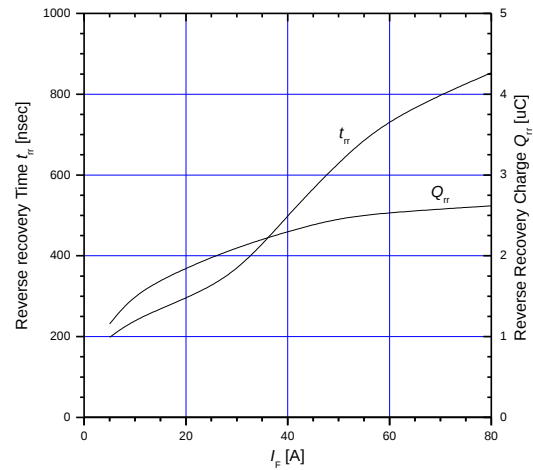


Figure 15. Typical reverse recovery loss vs. I_F

$V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \Omega$, $T_{Vj} = 175^\circ \text{C}$

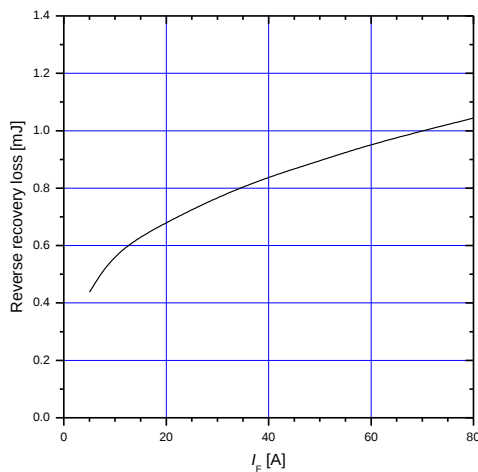


Figure 16. Reverse biased safe operating area

$V_{GE} = 15 \text{ V} / 0 \text{ V}$, $R_G = 10 \Omega$, $T_{Vj} \leq 175^\circ \text{C}$

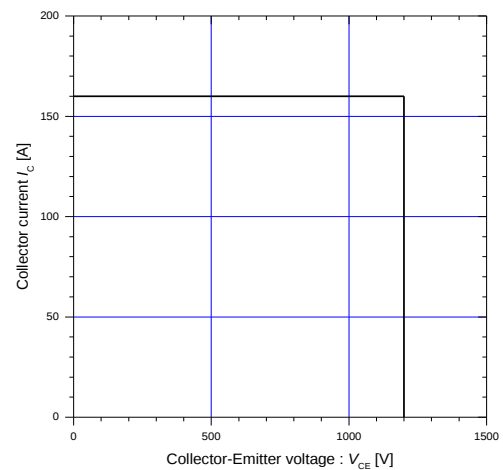


Figure 17. Transient Thermal Impedance of IGBT

$D = 0$

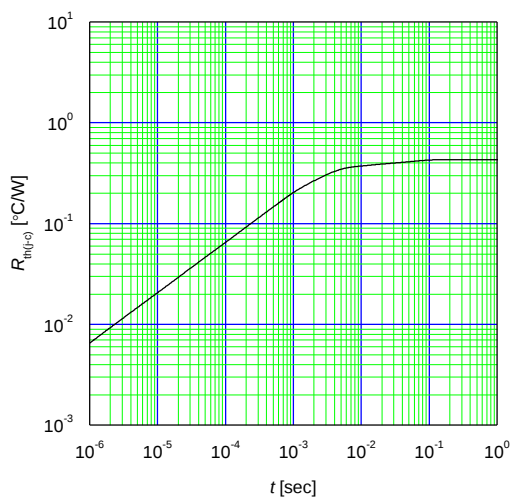
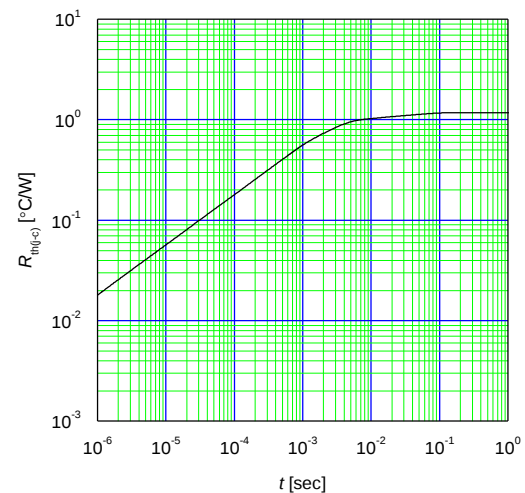


Figure 18. Transient Thermal Impedance of FWD

$D = 0$

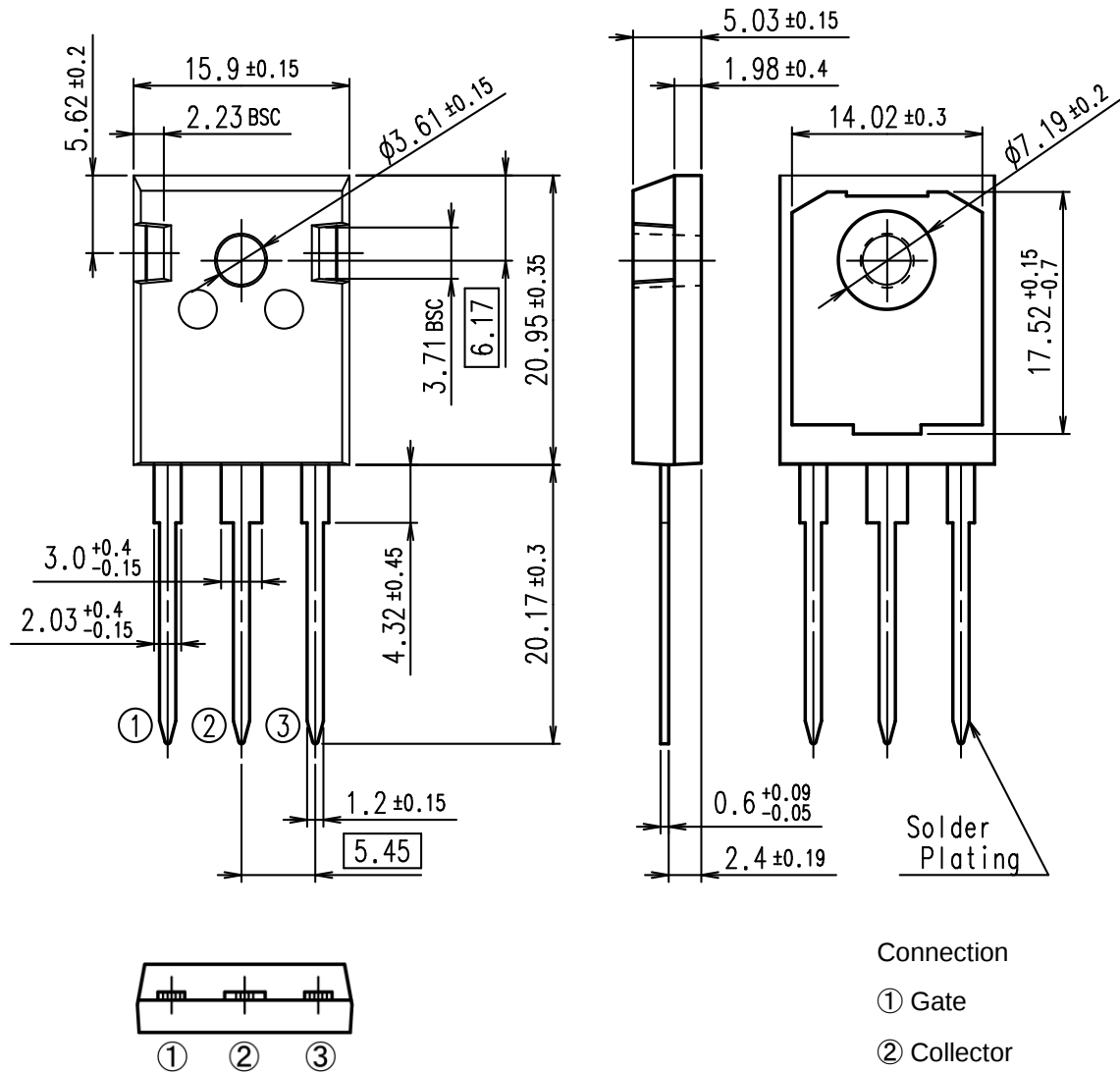


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■ Outline drawings,mm

Outview : TO-247 package



Dimensions are in millimeters.

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