

FGW40N65WE

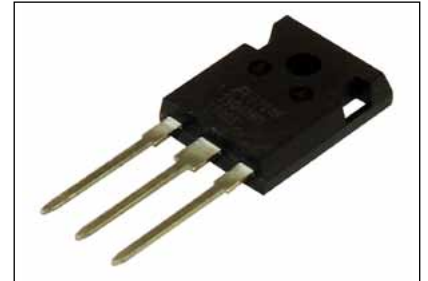
Discrete IGBT (High-Speed W series) 650V / 40A

Features

- Low power loss
- Low switching surge and noise
- High reliability, high ruggedness (RBSOA, SCSOA etc.)

Applications

- Uninterruptible power supply
- PV Power conditioner
- Inverter welding machine



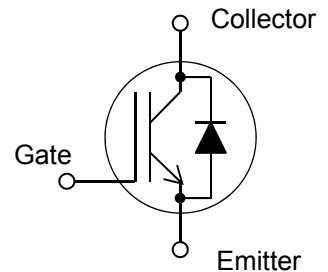
Maximum Ratings and Characteristics

Absolute Maximum Ratings at T_J=25°C (unless otherwise specified)

Items	Symbols	Characteristics	Unit	Remarks
Collector-Emitter Voltage	V _{CEs}	650	V	
Gate-Emitter Voltage	V _{GES}	±20	V	T _p <1μs
Transient Gate-Emitter Voltage		±30		
DC Collector Current	I _{C@25}	56	A	T _c =25°C
	I _{C@100}	40	A	T _c =100°C
Pulsed Collector Current	I _{CP}	160	A	Note *1
Turn-Off Safe Operating Area	-	160	A	V _{CE} ≤650V T _J ≤175°C
Diode Forward Current	I _{F@25}	61	A	
	I _{F@100}	40	A	
Diode Pulsed Current	I _{FP}	160	A	Note *1
IGBT Max. Power Dissipation	P _{D_IGBT}	260	W	T _c =25°C
FWD Max. Power Dissipation	P _{D_FWD}	155	W	T _c =25°C
Operating Junction Temperature	T _J	-40 ~ +175	°C	
Storage Temperature	T _{stg}	-55 ~ +175	°C	

Note *1 : Pulse width limited by T_{Jmax}.

Equivalent circuit



Electrical characteristics at T_J = 25°C (unless otherwise specified) Static Characteristics

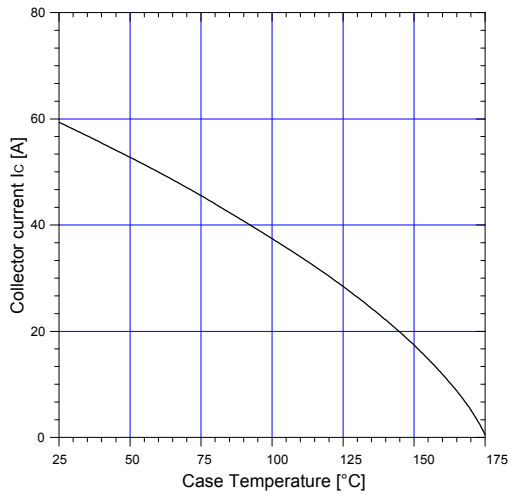
Description	Symbol	Conditions	min.	typ.	max.	Unit.
Zero Gate Voltage Collector Current	I _{CES}	V _{CE} = 650V, V _{GE} = 0V	-	-	250	μA
Gate-Emitter Leakage Current	I _{GES}	V _{CE} = 0V, V _{GE} = ±20V	-	-	200	nA
Gate-Emitter Threshold Voltage	V _{GE(th)}	V _{CE} = 20V, I _c = 40mA	3.0	4.0	5.0	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = 15V, I _c = 40A	-	1.80	2.20	V
Input Capacitance	C _{ies}	V _{CE} =25V	-	3000	-	pF
Output Capacitance	C _{oes}	V _{GE} =0V	-	85	-	
Reverse Transfer Capacitance	C _{res}	f=1MHz	-	64	-	
Gate Charge	Q _G	V _{CC} = 520V I _c = 40A V _{GE} = 15V	-	180	-	nC
Turn-On Delay Time	t _{d(on)}	T _J = 25°C, V _{CC} = 400V I _c = 20A, V _{GE} = 15V R _G = 10Ω, L = 500μH	-	24	-	ns
Rise Time	t _r		-	30	-	
Turn-Off Delay Time	t _{d(off)}		-	185	-	
Fall Time	t _f		-	47	-	
Turn-On Energy	E _{on}	Energy loss include "tail" and FWD reverse recovery.	-	0.29	-	mJ
Turn-Off Energy	E _{off}		-	0.29	-	
Turn-On Delay Time	t _{d(on)}	T _J = 150°C, V _{CC} = 400V I _c = 20A, V _{GE} = 15V R _G = 10Ω, L = 500μH	-	24	-	ns
Rise Time	t _r		-	30	-	
Turn-Off Delay Time	t _{d(off)}		-	215	-	
Fall Time	t _f		-	40	-	
Turn-On Energy	E _{on}	Energy loss include "tail" and FWD reverse recovery.	-	0.56	-	mJ
Turn-Off Energy	E _{off}		-	0.32	-	
Forward Voltage Drop	V _F	I _F =40A	-	2.5	3.2	V
			-	1.9	-	V
			-	1.7	-	V
Diode Reverse Recovery Time	t _{rr}	V _{CC} =400V, I _F =20A	-	100	-	ns
Diode Reverse Recovery Charge	Q _{rr}	-di _F /dt=500A/μs, T _J =25°C	-	0.29	-	μC
Diode Reverse Recovery Time	t _{rr}	V _{CC} =400V, I _F =20A	-	140	-	ns
Diode Reverse Recovery Charge	Q _{rr}	-di _F /dt=500A/μs, T _J =150°C	-	1.0	-	μC

● Thermal Resistance

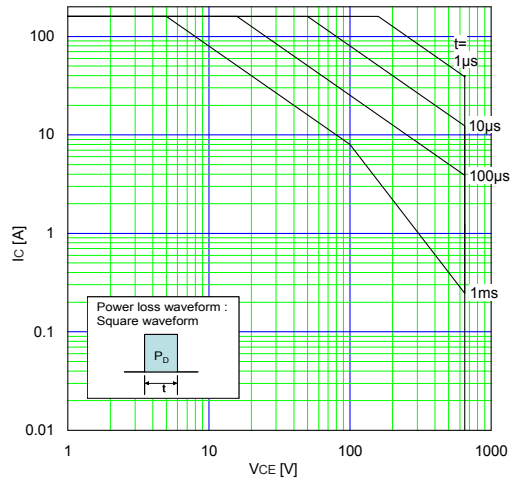
Description	Symbol	min.	typ.	max.	Unit
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	0.572	°C/W
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)}_{FWD}$	-	-	0.962	°C/W

Characteristics (Representative)

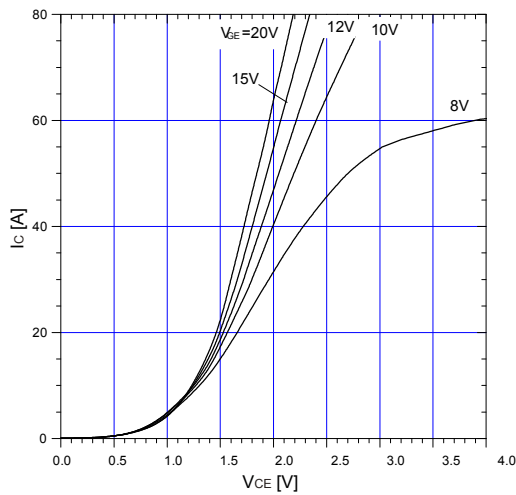
Graph.1
DC Collector Current vs Tc
V_{GE} ≥ +15V, T_j ≤ 175°C



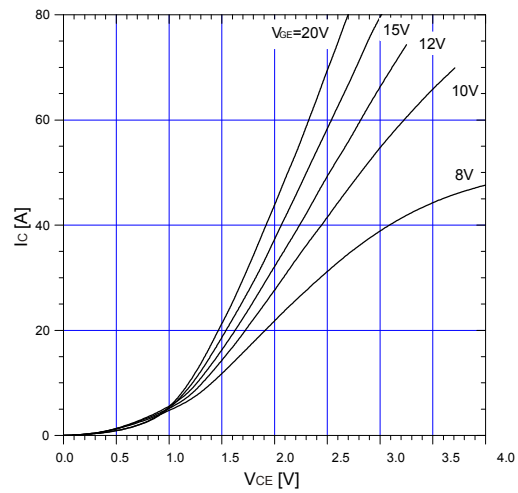
Graph.2
SOA
Duty=0(Single pulse), Tc=25°C



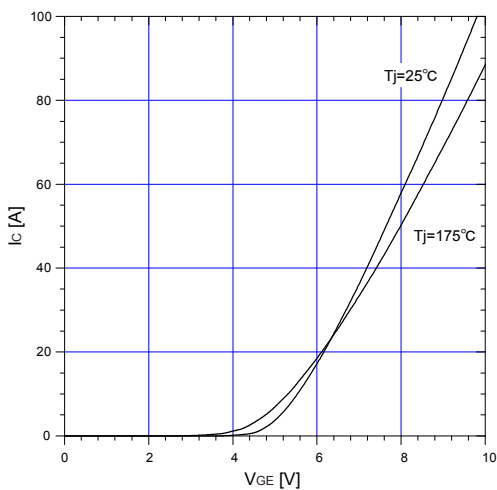
Graph.3
Typical Output Characteristics (V_{CE}-I_C)
T_j=25°C



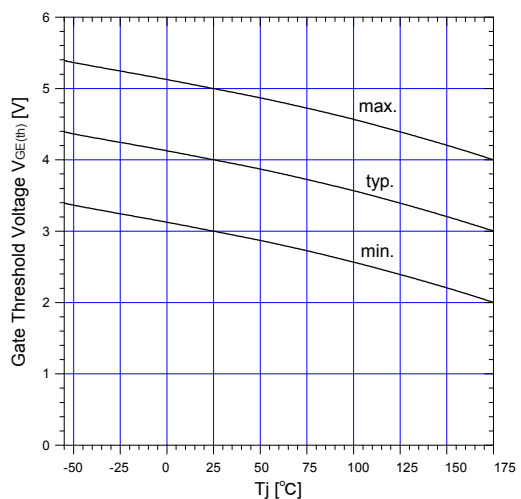
Graph.4
Typical Output Characteristics (V_{CE}-I_C)
T_j=175°C



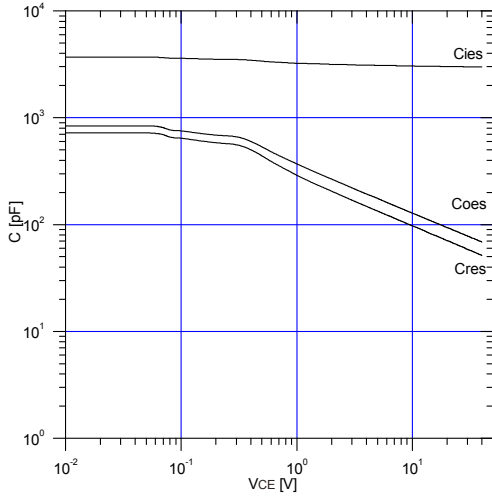
Graph.5
Typical Transfer Characteristics
V_{CE}=10V



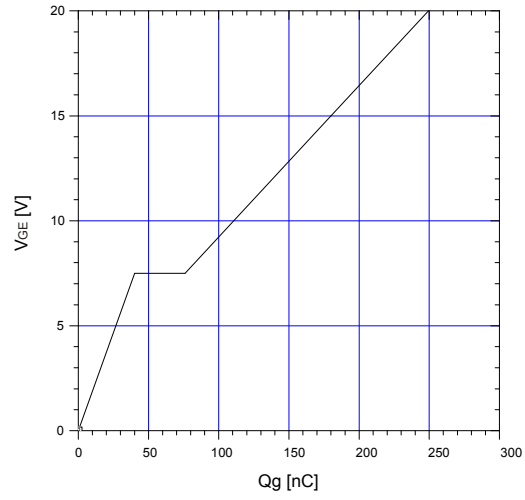
Graph.6
Gate Threshold Voltage vs. T_j
Ic=40mA, V_{CE}=20V



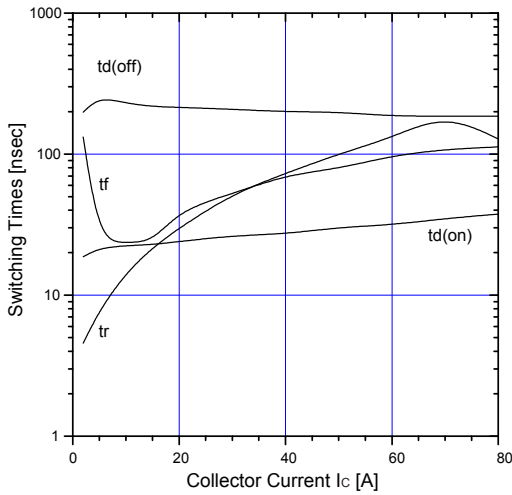
Graph.7
Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_j=25^\circ C$



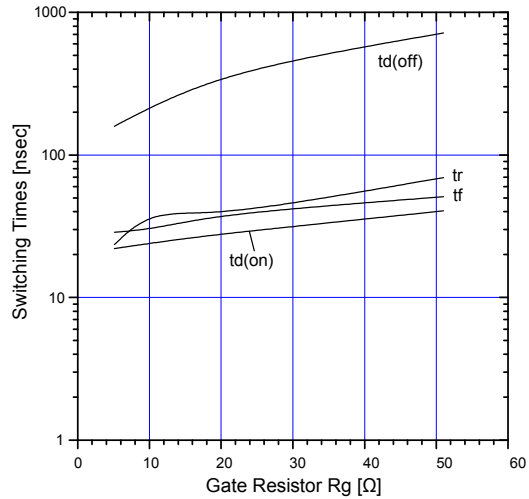
Graph.8
Typical Gate Charge
 $V_{cc}=520V, I_c=40A, T_j=25^\circ C$



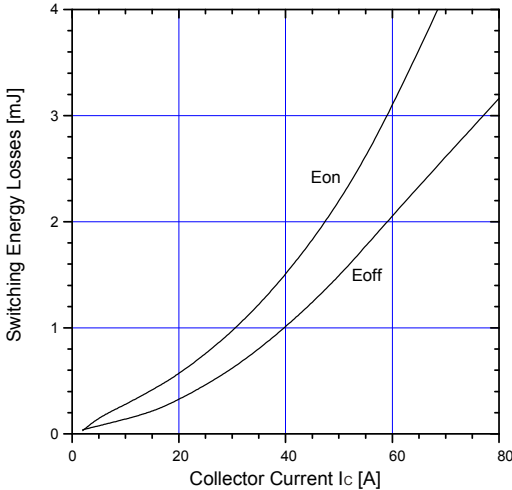
Graph.9
Typical switching time vs. I_c
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



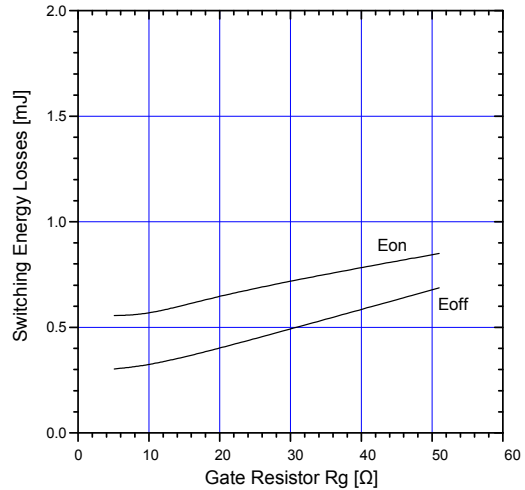
Graph.10
Typical switching time vs. R_g
 $T_j=150^\circ C, V_{cc}=400V, I_c=20A, L=500\mu H$
 $V_{GE}=15V$



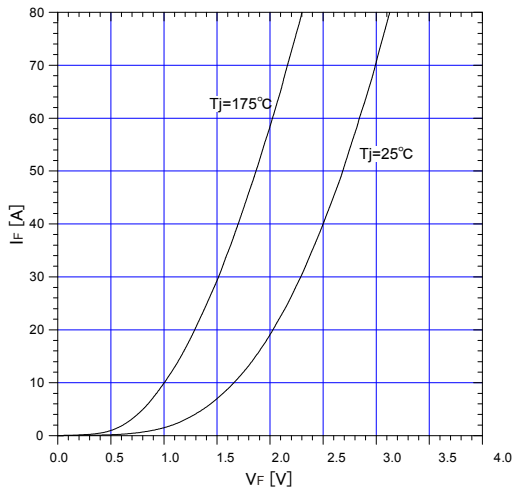
Graph.11
Typical switching losses vs. I_c
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



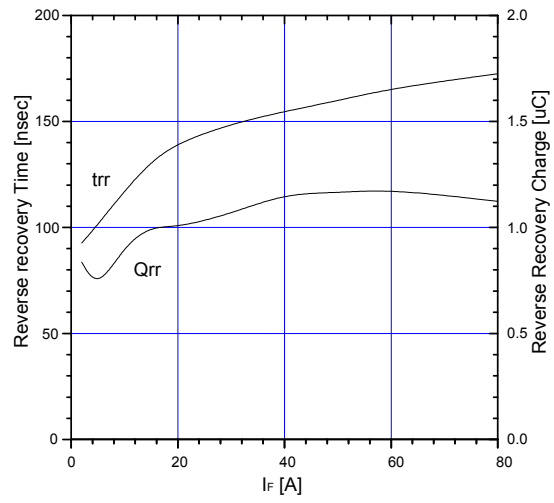
Graph.12
Typical switching losses vs. R_g
 $T_j=150^\circ C, V_{cc}=400V, I_c=20A, L=500\mu H$
 $V_{GE}=15V$



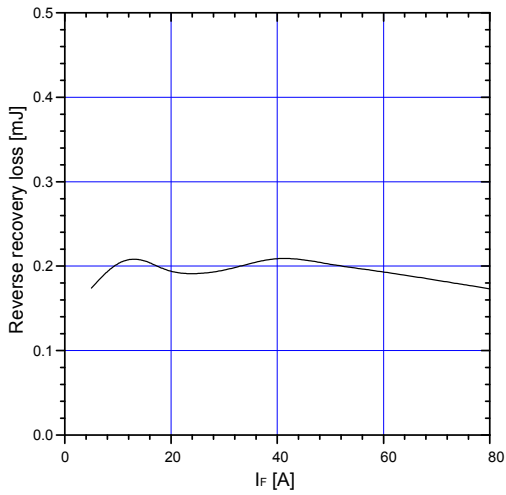
Graph.13
FWD Forward voltage drop (V_F - I_F)



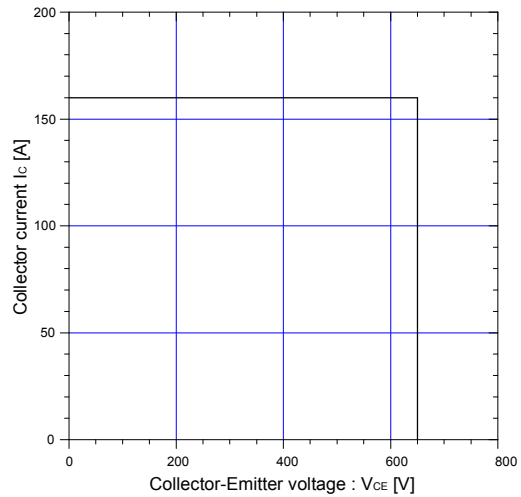
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_j=15^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



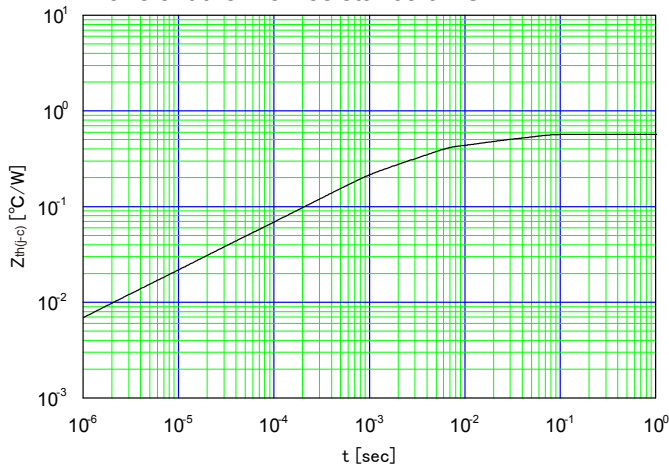
Graph.15
Typical reverse recovery loss vs. I_F
 $T_j=150^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



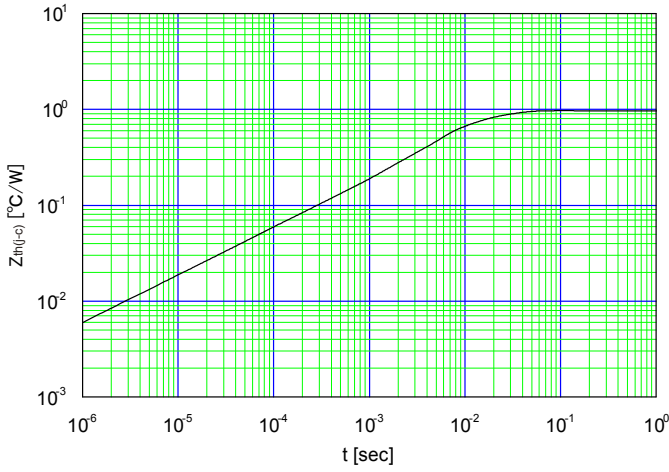
Graph.16
Reverse biased Safe Operating Area
 $T_j \leq 175^\circ\text{C}$, $V_{GE}=+15\text{V}/0\text{V}$, $R_G=10\Omega$



Graph.17
Transient thermal resistance of IGBT

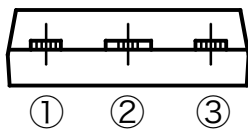
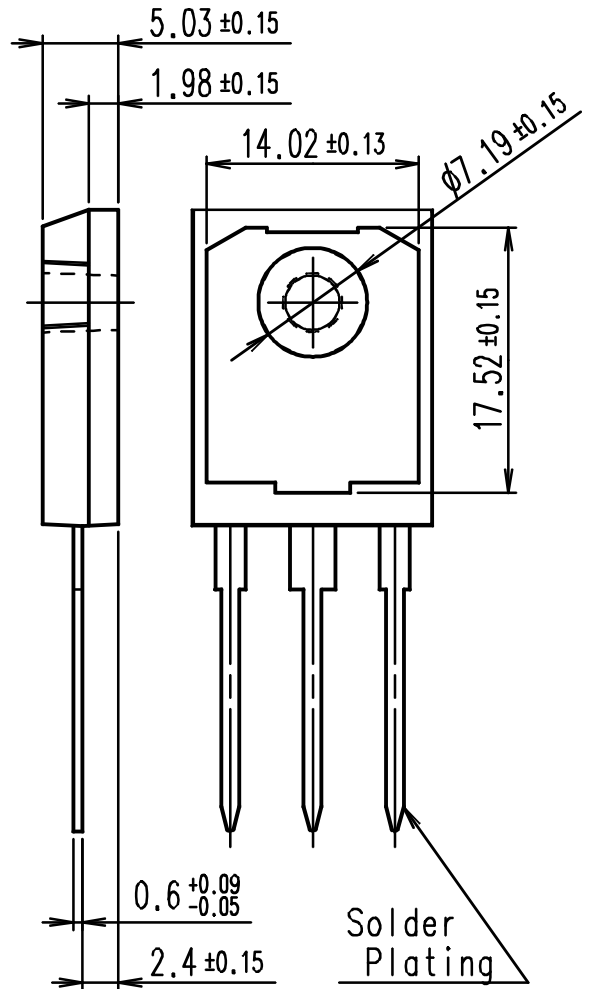
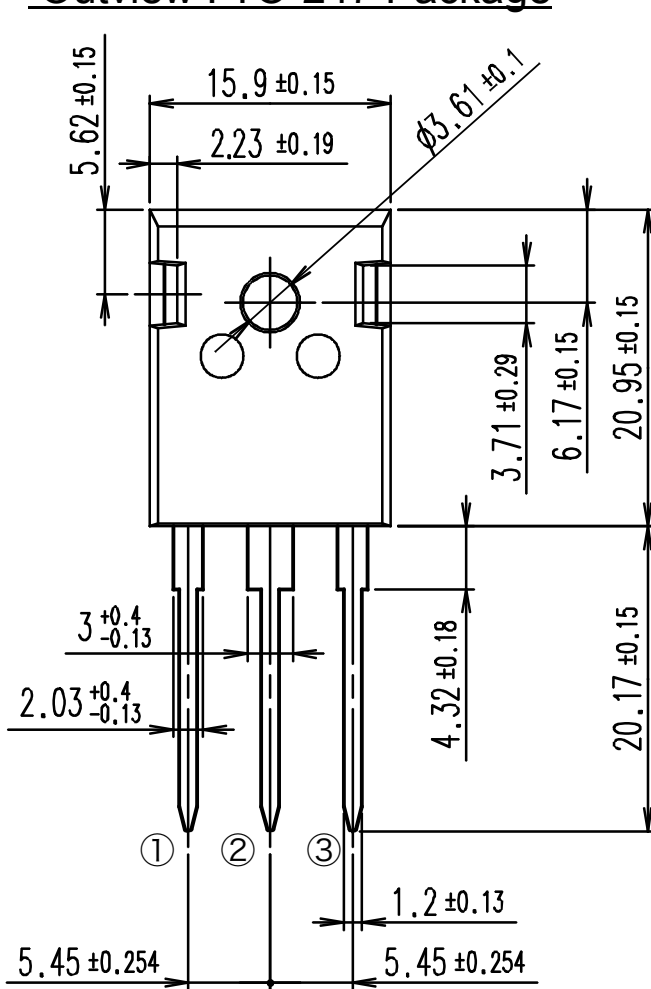


Graph.18
Transient thermal resistance of FWD



■ Outline Drawings, mm

Overview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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