

FGW50N60VD

Discrete IGBT

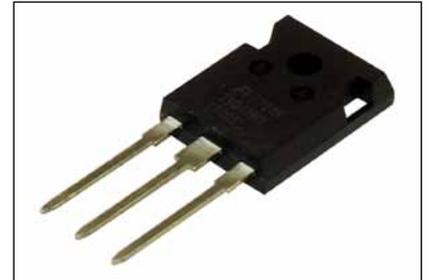
Discrete IGBT (High-Speed V series) 600V / 50A

■ Features

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

■ Applications

- Inverter for Motor drive
- AC and DC Servo drive amplifier
- Uninterruptible power supply



■ Maximum Ratings and Characteristics

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

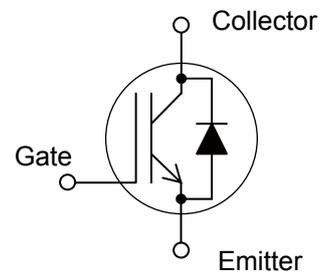
Items	Symbols	Characteristics	Units	Remarks
Collector-Emitter voltage	V _{CEs}	600	V	
Gate-Emitter voltage	V _{GES}	±20	V	
DC Collector Current	I _{C@25}	85	A	T _c =25°C, T _j =150°C
	I _{C@100}	50	A	T _c =100°C, T _j =150°C
Pulsed Collector Current	I _{CP}	100	A	Note *1
Turn-Off Safe Operating Area	-	100	A	V _{CE} ≤600V, T _j ≤175°C
Diode Forward Current	I _{F@25}	70	A	
	I _{F@100}	35	A	
Diode Pulsed Current	I _{FP}	100	A	Note *1
Short Circuit Withstand Time	t _{sc}	10	μs	V _{CE} ≤320V, V _{GE} =15V T _j ≤150°C
IGBT Max. Power Dissipation	P _{D_IGBT}	360	W	T _c =25°C
FWD Max. Power Dissipation	P _{D_FWD}	220	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}.

● Electrical characteristics (at T_j= 25°C unless otherwise specified)

Items	Symbols	Conditions	Characteristics			Unit	
			min.	typ.	max.		
Collector-Emitter Breakdown Voltage	V _{BR(ICES)}	I _C = 250μA, V _{GE} = 0V	600	-	-	V	
Zero Gate Voltage Collector Current	I _{CEs}	V _{CE} = 600V, V _{GE} = 0V	T _j =25°C	-	-	250	μA
			T _j =175°C	-	-	10	mA
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 = 50mA	6.2	6.7	7.2	V	
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = +15V, I _C = 50A	T _j =25°C	-	1.60	2.05	V
			T _j =175°C	-	2.1	-	
Input Capacitance	C _{ies}	V _{CE} =25V	-	2900	-	pF	
Output Capacitance	C _{oes}	V _{GE} =0V	-	215	-		
Reverse Transfer Capacitance	C _{res}	f=1MHz	-	175	-		
Gate Charge	Q _G	V _{CC} = 400V I _C = 50A V _{GE} = 15V	-	360	-	nC	
Turn-On Delay Time	t _{d(on)}	T _j = 25°C V _{CC} = 400V I _C = 50A V _{GE} = 15V R _G = 10Ω L = 500μH	-	45	-	ns	
Rise Time	t _r		-	90	-		
Turn-Off Delay Time	t _{d(off)}		-	310	-		
Fall Time	t _f		-	55	-		
Turn-On Energy	E _{on}		-	2.4	-		mJ
Turn-Off Energy	E _{off}	Energy loss include "tail" and FWD reverse recovery.	-	1.4	-		
Turn-On Delay Time	t _{d(on)}	T _j = 175°C V _{CC} = 400V I _C = 50A V _{GE} = 15V R _G = 10Ω L = 500μH	-	45	-	ns	
Rise Time	t _r		-	100	-		
Turn-Off Delay Time	t _{d(off)}		-	340	-		
Fall Time	t _f		-	60	-		
Turn-On Energy	E _{on}		-	4.1	-		mJ
Turn-Off Energy	E _{off}	Energy loss include "tail" and FWD reverse recovery.	-	2.0	-		
Forward Voltage Drop	V _F	I _F =35A	T _j =25°C	-	1.5	1.95	V
			T _j =175°C	-	1.3	-	V
Diode Reverse Recovery Time	t _{rr1}	V _{CC} =30V I _F = 3.5A -di _F /dt=200A/μs	-	50	65	ns	
Diode Reverse Recovery Time	t _{rr2}	V _{CC} =400V I _F =35A	-	0.31	-	μs	
Diode Reverse Recovery Charge	Q _{rr}	-di _F /dt=200A/μs T _j =25°C	-	0.75	-	μC	

■ Equivalent circuit



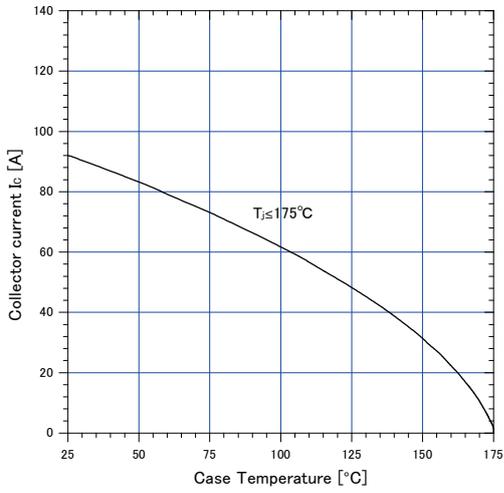
Items	Symbols	Conditions	Characteristics			Unit
			min.	typ.	max.	
Diode Reverse Recovery Time	t_{rr2}	$V_{CC}=400V$ $I_F=35A$	-	0.49	-	μs
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=200A/\mu s$ $T_j=175^\circ C$	-	3.3	-	μC

● Thermal resistance

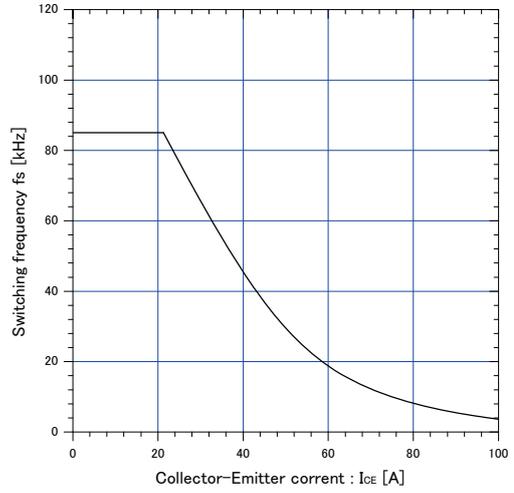
Items	Symbols	Characteristics			Unit
		min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	$^\circ C/W$
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	0.417	
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)}_{FWD}$	-	-	0.735	

■ Characteristics (Representative)

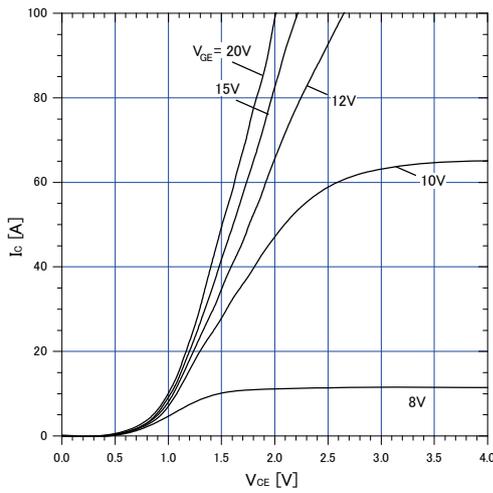
Graph.1
DC Collector Current vs T_c
 $V_{GE} \geq +15V, T_J \leq 175^\circ C$



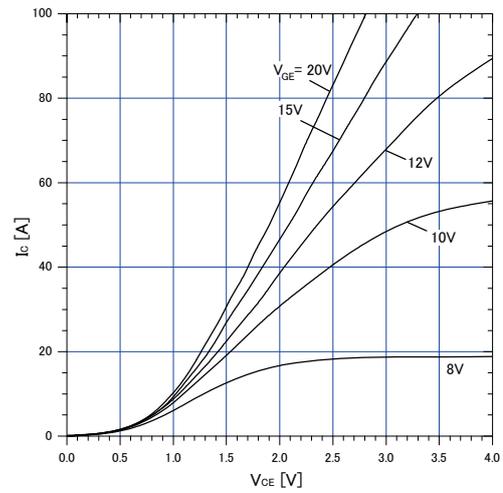
Graph.2
Collector Current vs. switching frequency
 $V_{GE} = +15V, T_c \leq 175^\circ C, V_{CC} = 400V, D = 0.5, R_G = 10\Omega, T_c = 100^\circ C$



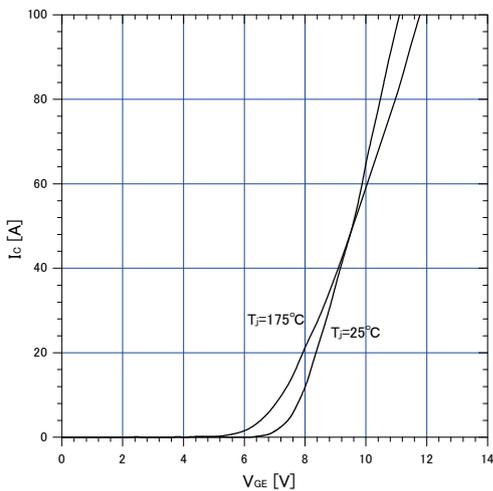
Graph.3
Typical Output Characteristics ($V_{CE} - I_c$)
 $T_J = 25^\circ C$



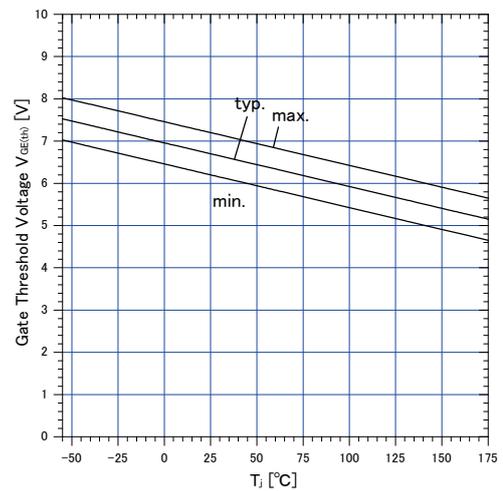
Graph.4
Typical Output Characteristics ($V_{CE} - I_c$)
 $T_J = 175^\circ C$



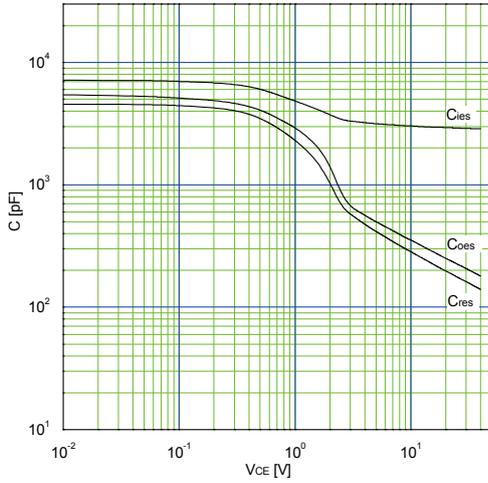
Graph.5
Typical Transfer Characteristics
 $V_{GE} = +15V$



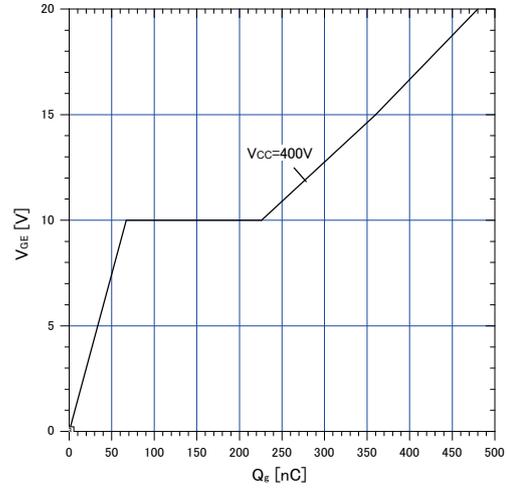
Graph.6
Gate Threshold Voltage vs. T_J
 $I_c = 50mA, V_{CE} = 20V$



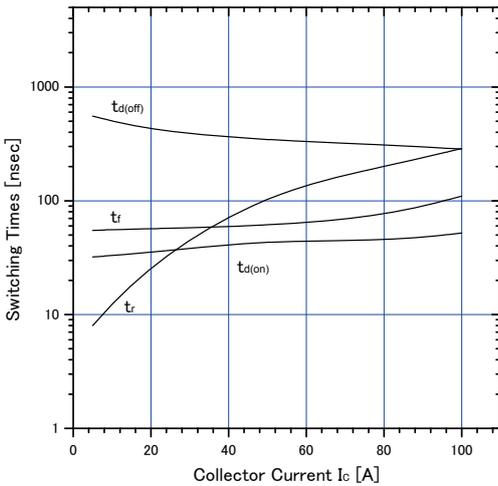
Graph.7
Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_j=25^\circ C$



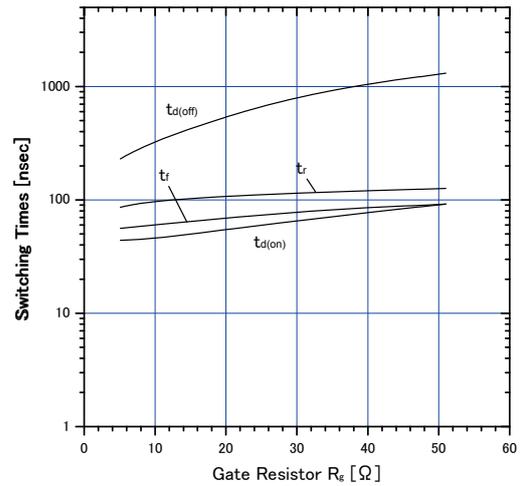
Graph.8
Typical Gate Charge
 $V_{CC}=400V, I_c=50A, T_j=25^\circ C$



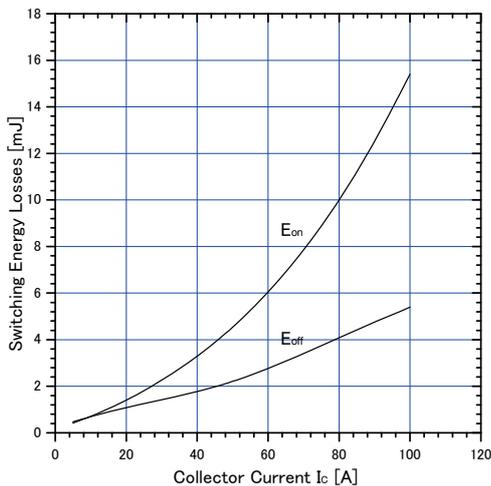
Graph.9
Typical switching time vs. I_c
 $T_j=175^\circ C, V_{CC}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



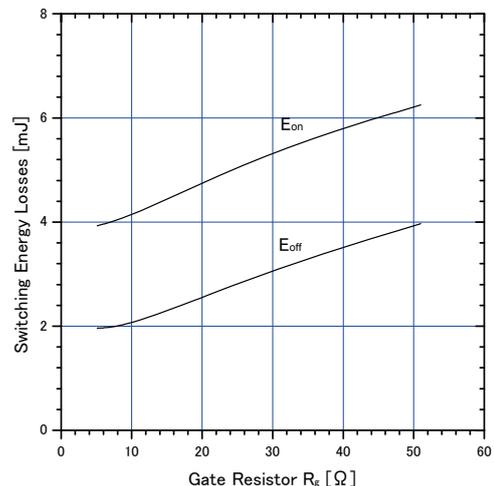
Graph.10
Typical switching time vs. R_G
 $T_j=175^\circ C, V_{CC}=400V, I_c=50A, L=500\mu H$
 $V_{GE}=15V$



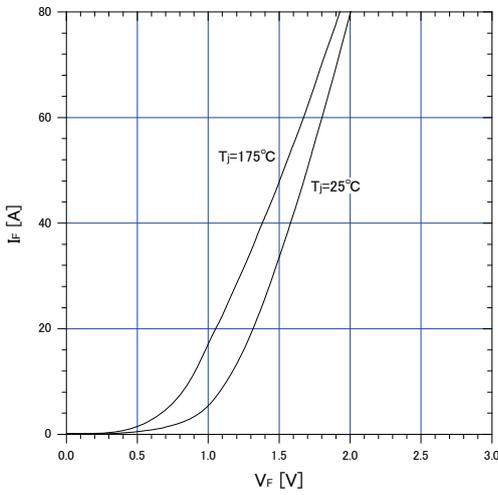
Graph.11
Typical switching losses vs. I_c
 $T_j=175^\circ C, V_{CC}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



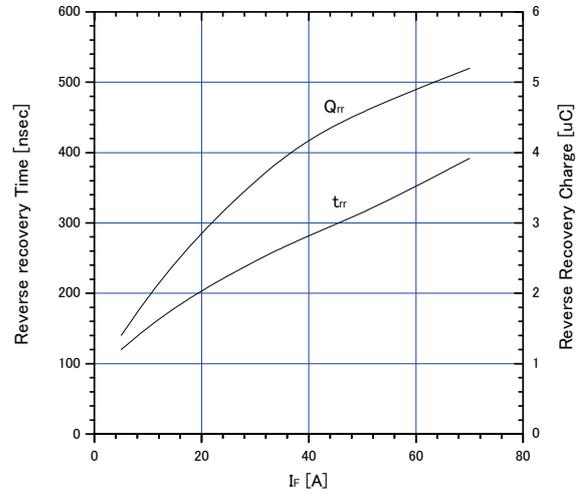
Graph.12
Typical switching losses vs. R_G
 $T_j=175^\circ C, V_{CC}=400V, I_c=50A, L=500\mu H$
 $V_{GE}=15V$



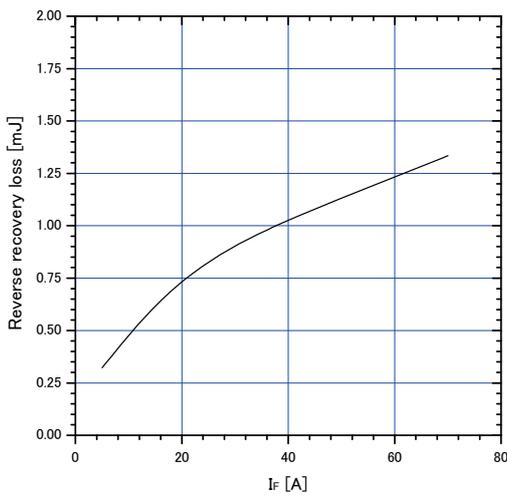
Graph.13
FWD Forward voltage drop (V_F-I_F)



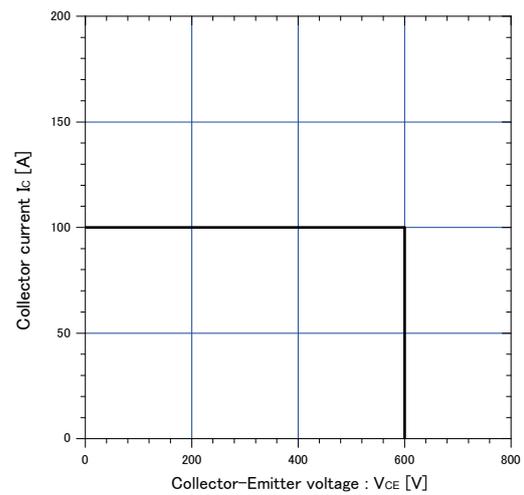
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$,
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



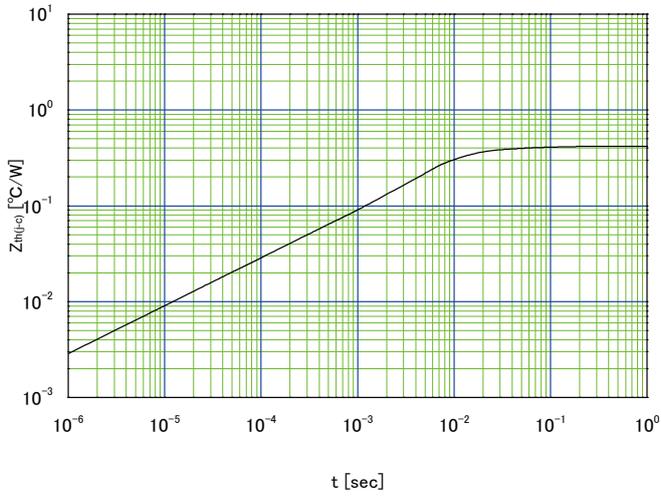
Graph.15
Typical reverse recovery loss vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



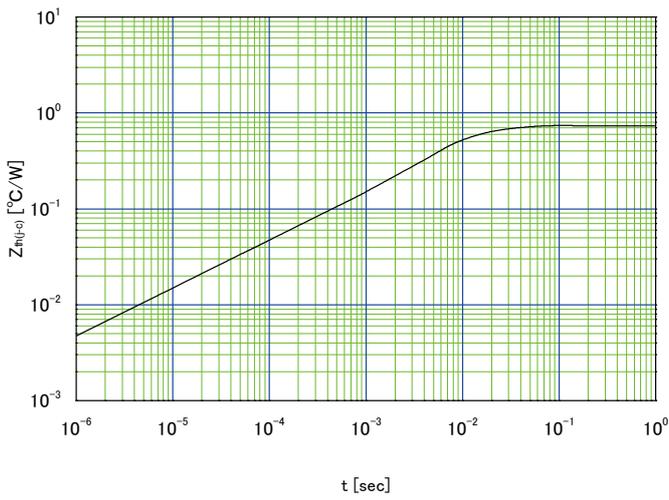
Graph.16
Reverse biased Safe Operating Area
 $T_J \leq 175^\circ\text{C}$, $V_{GE}=+15\text{V}/0\text{V}$, $R_G=10\Omega$



Graph.17
Transient thermal resistance of IGBT

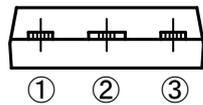
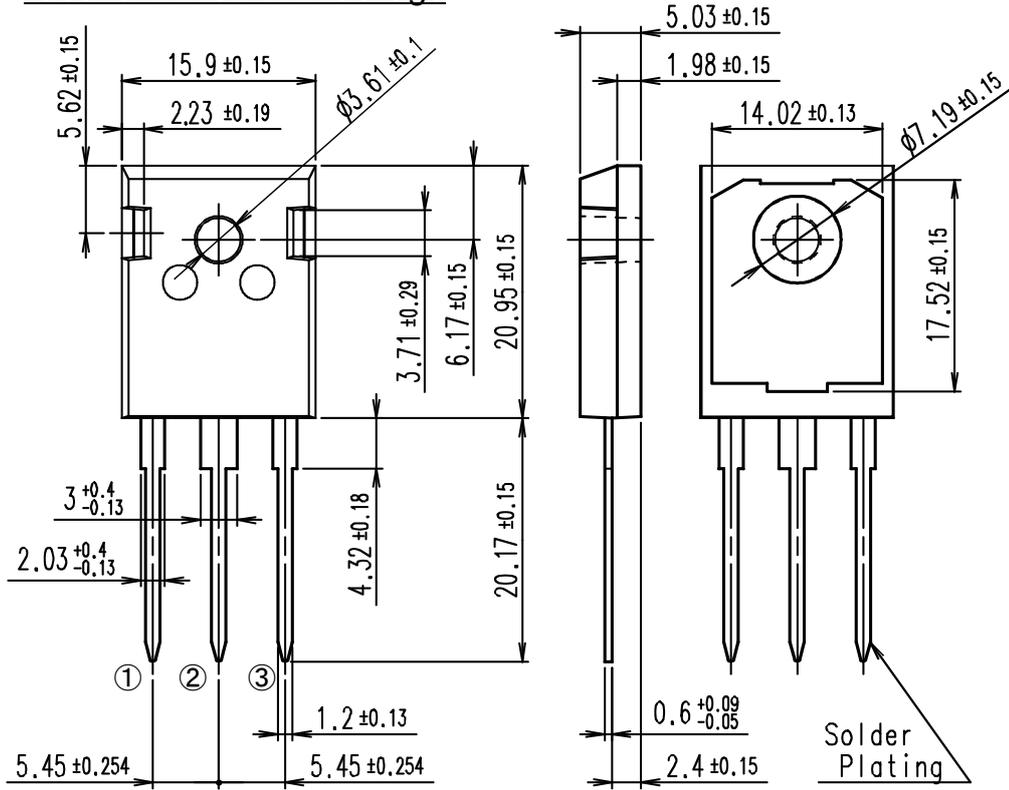


Graph.18
Transient thermal resistance of FWD



■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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