

FGW50N60HC

Discrete IGBT

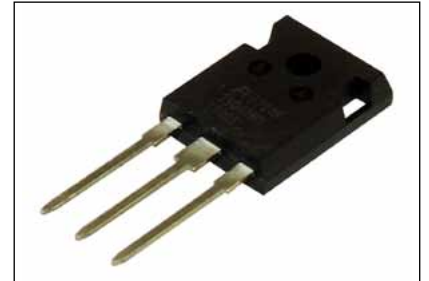
Discrete IGBT (High-Speed V series) 600V / 50A

■ Features

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

■ Applications

- Uninterruptible power supply
- Power conditioner
- Power factor correction circuit



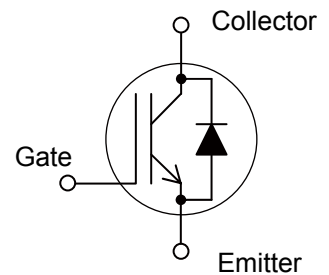
■ Maximum Ratings and Characteristics

● Absolute Maximum Ratings (at T_J=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} I _{C@100}	95 50	A	T _C =25°C, T _J =150°C T _C =100°C, T _J =150°C
Pulsed Collector Current	I _{CP}	150	A	Note *1
Turn-Off Safe Operating Area	-	150	A	V _{CE} ≤600V, T _J ≤175°C
Diode Forward Current	I _{F@25} I _{F@100}	76 50	A	
Diode Pulsed Current	I _{FP}	150	A	Note *1
Short Circuit Withstand Time	t _{SC}	5	μs	V _{CE} ≤300V, V _{GE} =12V T _J ≤150°C
IGBT Max. Power Dissipation	P _{D,IGBT}	360	W	T _C =25°C
FWD Max. Power Dissipation	P _{D,FWD}	190	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)

Description	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Collector-Emitter Breakdown Voltage	V _{(BR)CES}	I _C = 250μA, V _{GE} = 0V	600	-	-	V
Zero Gate Voltage Collector Current	I _{CES}	V _{CE} = 600V, V _{GE} = 0V	-	-	250	μA
Gate-Emitter Leakage Current	I _{GES}	V _{CE} = 0V, V _{GE} = ±20V	-	-	10	nA
Gate-Emitter Threshold Voltage	V _{GE(th)}	V _{CE} = +20V, I _C = 50mA	4.0	5.0	6.0	V
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = +15V, I _C = 50A	-	1.50	1.95	V
Input Capacitance	C _{ies}	V _{CE} =25V	-	4320	-	pF
Output Capacitance	C _{oes}	V _{GE} =0V	-	210	-	pF
Reverse Transfer Capacitance	C _{res}	f=1MHz	-	160	-	pF
Gate Charge	Q _G	V _{CC} = 400V I _C = 50A V _{GE} = 15V	-	305	-	nC
Turn-On Delay Time	t _{d(on)}	T _J = 25°C	-	33	-	ns
Rise Time	t _r	V _{CC} = 400V	-	70	-	ns
Turn-Off Delay Time	t _{d(off)}	I _C = 50A	-	310	-	ns
Fall Time	t _f	V _{GE} = 15V	-	60	-	ns
Turn-On Energy	E _{on}	R _G = 10Ω	-	1.5	-	mJ
Turn-Off Energy	E _{off}	L = 500μH Energy loss include "tail" and FWD reverse recovery.	-	1.7	-	mJ
Turn-On Delay Time	t _{d(on)}	T _J = 175°C	-	30	-	ns
Rise Time	t _r	V _{CC} = 400V	-	62	-	ns
Turn-Off Delay Time	t _{d(off)}	I _C = 50A	-	335	-	ns
Fall Time	t _f	V _{GE} = 15V	-	72	-	ns
Turn-On Energy	E _{on}	R _G = 10Ω	-	2.2	-	mJ
Turn-Off Energy	E _{off}	L = 500μH Energy loss include "tail" and FWD reverse recovery.	-	2.2	-	mJ

● FWD Characteristics

Description	Symbol	Conditions	Characteristics			Unit
			min.	typ.	max.	
Forward Voltage Drop	V_F	$I_F=50A$	-	2.25	2.95	V
		$T_J=25^{\circ}C$ $T_J=175^{\circ}C$	-	1.65	-	V
Diode Reverse Recovery Time	t_{rr1}	$V_{CC}=30V, I_F = 5A$ $-di/dt=200A/\mu s$	-	30	41	ns
Diode Reverse Recovery Time	t_{rr2}	$V_{CC}=400V$ $I_F=50A$	-	0.04	-	μs
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=200A/\mu s$ $T_J=25^{\circ}C$	-	0.07	-	μC
Diode Reverse Recovery Time	t_{rr2}	$V_{CC}=400V$ $I_F=50A$	-	0.16	-	μs
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=200A/\mu s$ $T_J=175^{\circ}C$	-	1.00	-	μC

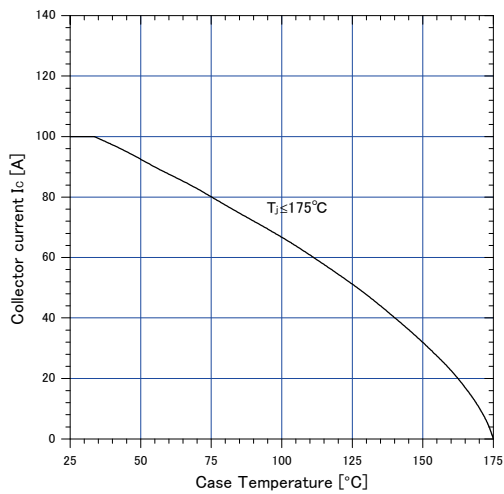
● Thermal Resistance

Description	Symbols	Conditions	Characteristics			Units
			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	$R_{th(j-c)}_{FWD}$	-	-	-	0.781	

■ Characteristics (Representative)

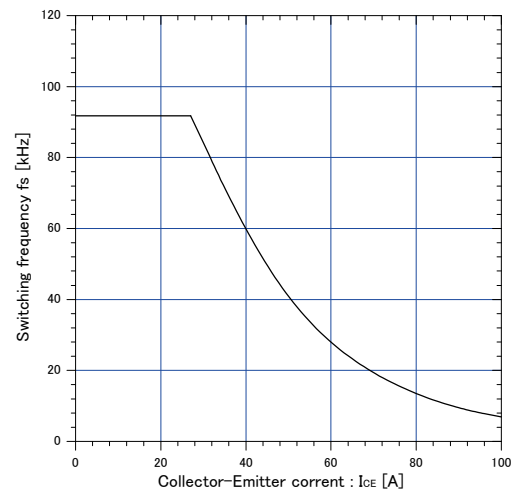
Graph.1

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



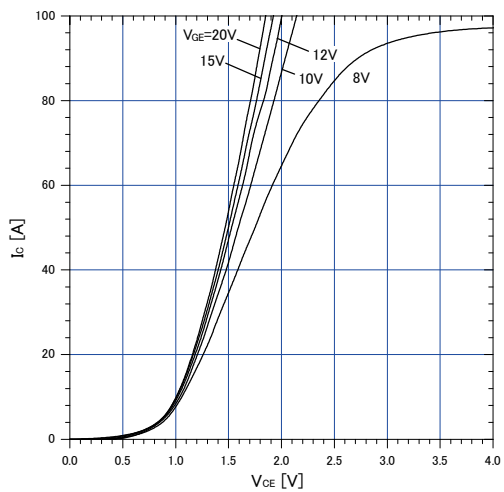
Graph.2

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



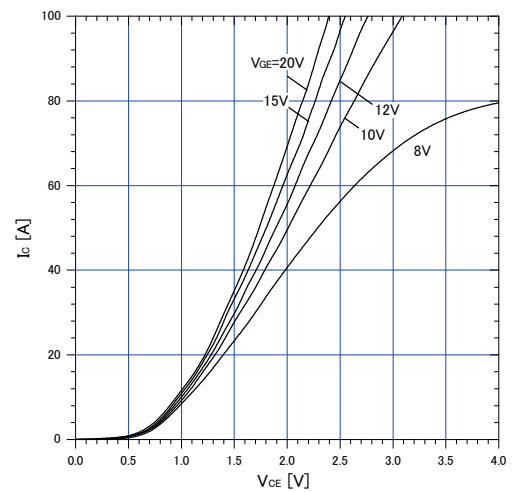
Graph.3

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



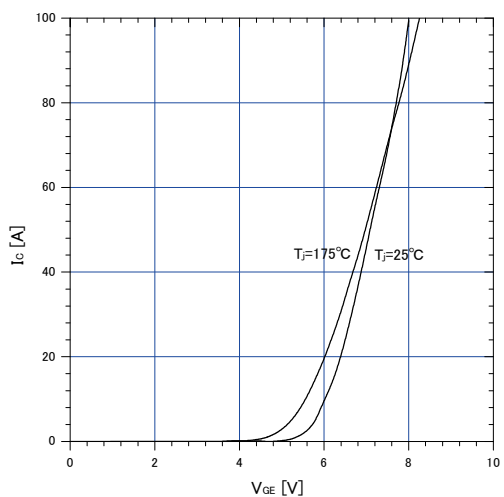
Graph.4

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



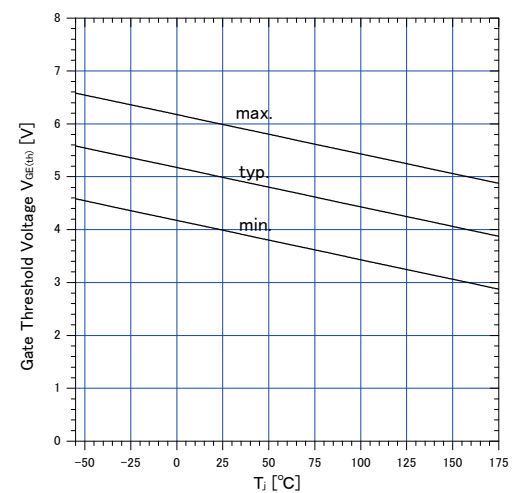
Graph.5

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

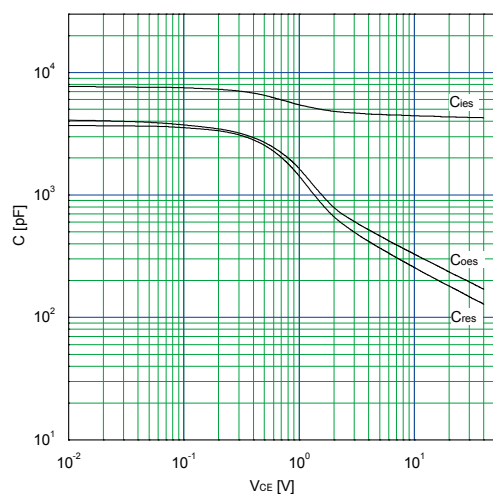


Graph.6

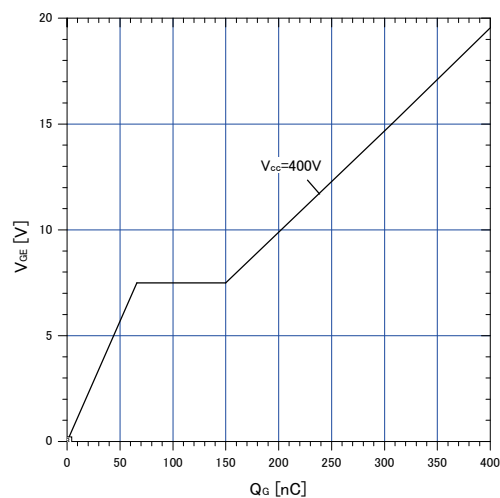
Gate Threshold Voltage vs. T_J
 $I_c = 50mA$, $V_{CE} = 20V$



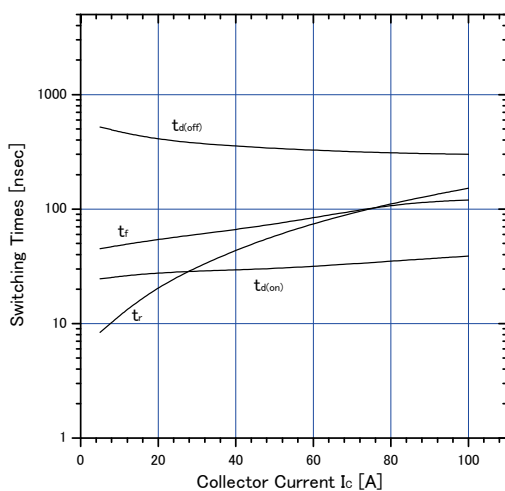
Graph.7
Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_J=25^{\circ}C$



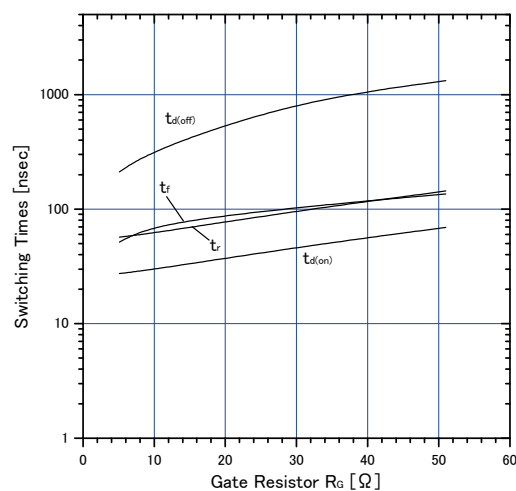
Graph.8
Typical Gate Charge
 $V_{CC}=400V, I_c=50A, T_J=25^{\circ}C$



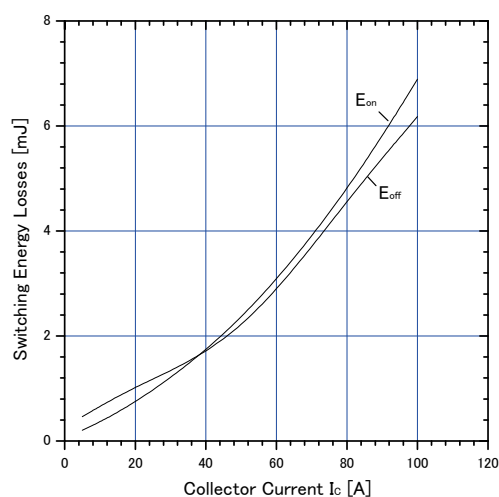
Graph.9
Typical switching time vs. I_c
 $T_J=175^{\circ}C, V_{CC}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



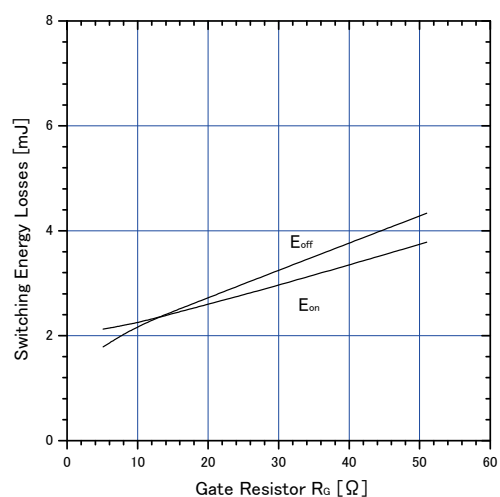
Graph.10
Typical switching time vs. R_G
 $T_J=175^{\circ}C, V_{CC}=400V, I_c=50A, L=500\mu H$
 $V_{GE}=15V$



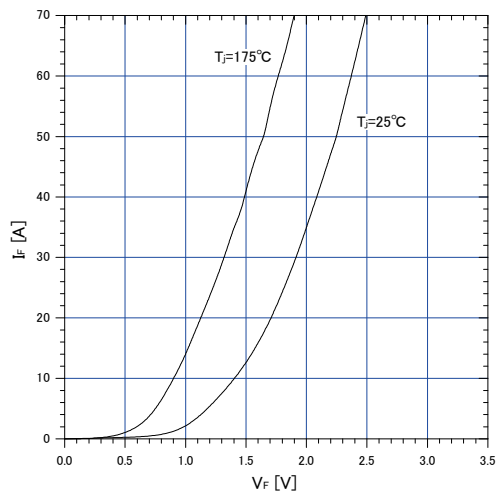
Graph.11
Typical switching losses vs. I_c
 $T_J=175^{\circ}C, V_{CC}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



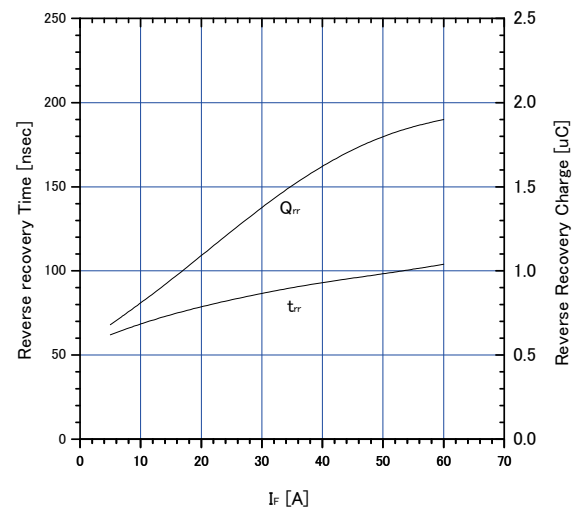
Graph.12
Typical switching losses vs. R_G
 $T_J=175^{\circ}C, V_{CC}=400V, I_c=50A, L=500\mu H$
 $V_{GE}=15V$



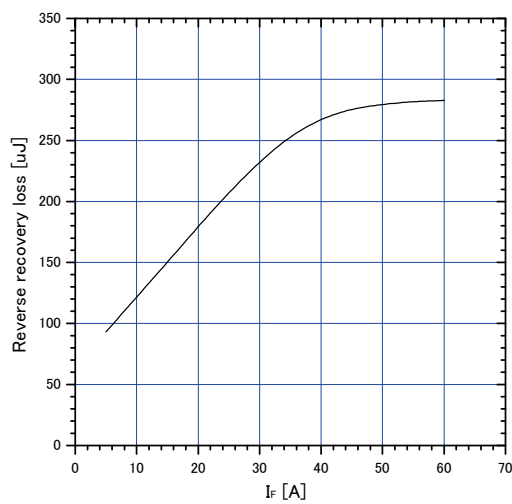
Graph.13
FWD Forward voltage drop (V_F-I_F)



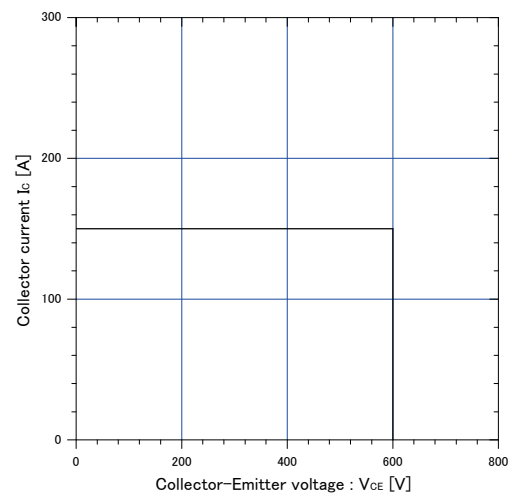
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



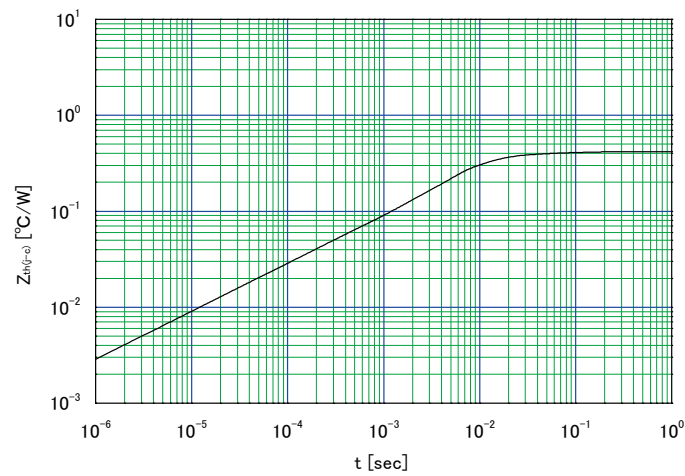
Graph.15
Typical reverse recovery loss vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



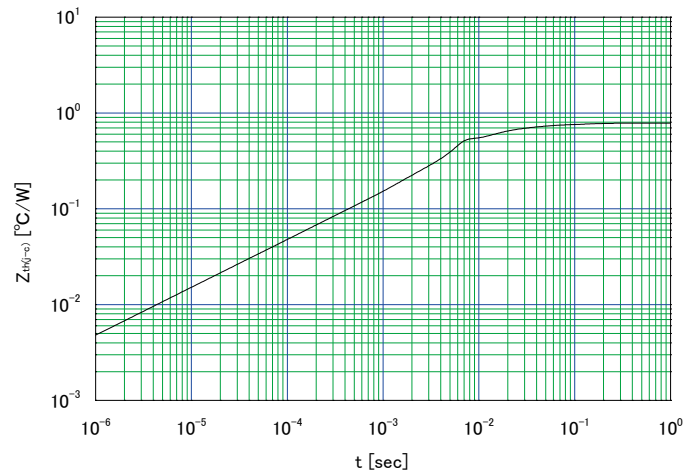
Graph.16
Reverse biased Safe Operating Area
 $T_J \leq 175^\circ\text{C}$, $V_{GE}=+15\text{V}/0\text{V}$, $R_G=10\Omega$



Graph.17
Transient thermal resistance of IGBT

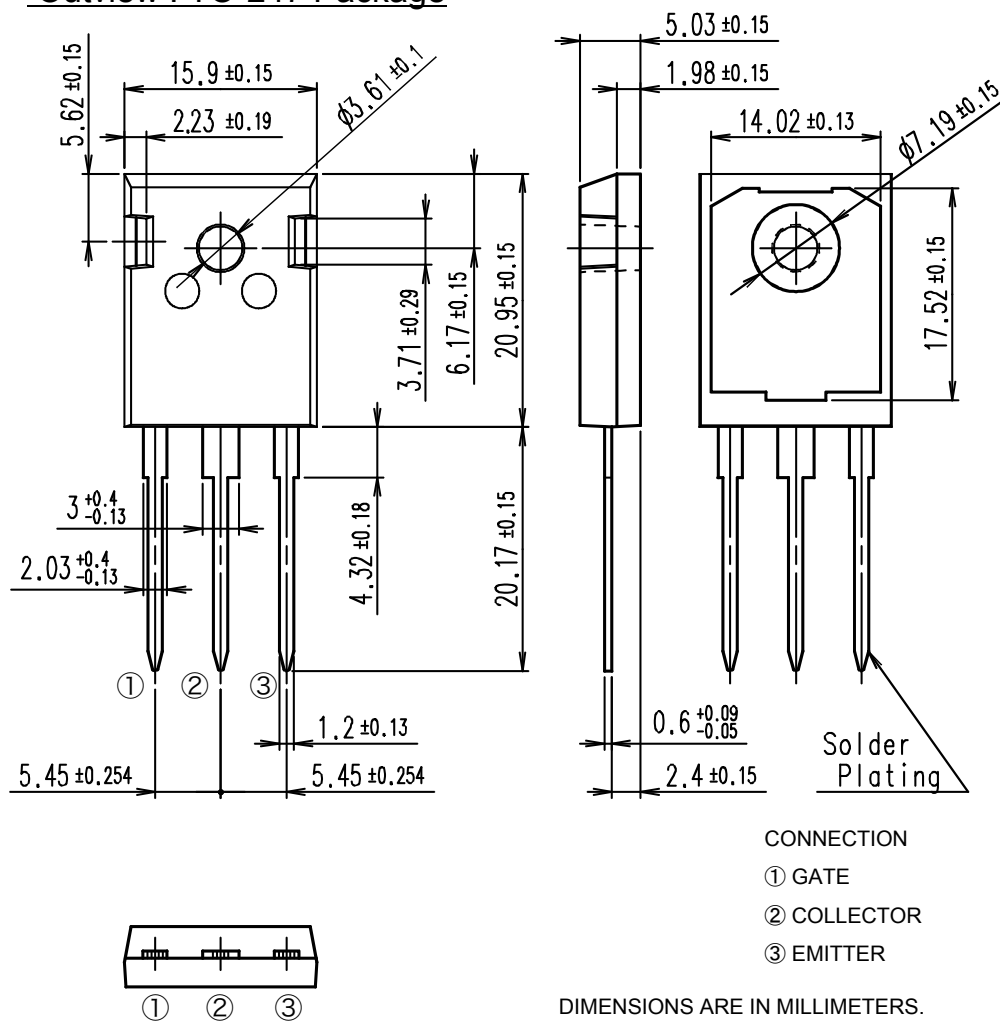


Graph.18
Transient thermal resistance of FWD



Outline Drawings, mm

Outview : TO-247 Package



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