

General Description

This IGBT is produced using advanced Magnachip's Field Stop Trench IGBT Technology, which provides high switching speed and excellent quality.

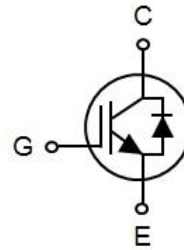
Features

- High Speed Switching & Low Power Loss
- $V_{CE(sat)} = 1.8V @ I_c = 40A$
- Maximum junction temperature 175°C

Applications

- Inverters
- Welding converters
- High range switching frequency converters

TO-247



Maximum Rating

Parameter	Symbol	Rating	Unit
Collector-emitter voltage	V_{CE}	650	V
DC collector current, limited by T_{vjmax}	I_c	$T_C=25^\circ C$	80
		$T_C=100^\circ C$	40
Pulsed collector current, t_p limited by T_{vjmax}	I_{cpuls}	120	A
Diode forward current limited by T_{vjmax}	I_F	$T_C=25^\circ C$	40
		$T_C=100^\circ C$	20
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	120	A
Gate-emitter voltage	V_{GE}	± 20	V
Power dissipation	P_D	$T_C=25^\circ C$	230
		$T_C=100^\circ C$	115
Operating Junction temperature range	T_{vj}	-40~175	$^\circ C$
Storage temperature range	T_{stg}	-55~150	$^\circ C$

Thermal Characteristic

Parameter	Symbol	Rating	Unit
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	$^\circ C/W$
Thermal resistance junction-to-case for IGBT	$R_{\theta JC}$	0.65	
Thermal resistance junction-to-case for Diode	$R_{\theta JC}$	1.75	

Ordering Information

Part Number	Marking	Temp. Range	Package	Packing	RoHS Status
MBQ40T65QESTH	40T65QES	-55~150°C	TO-247	Tube	Halogen Free

Electrical Characteristic (T_{vj} = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Static Characteristic							
Collector-emitter breakdown voltage	BV _{CES}	I _C = 2mA, V _{GE} = 0V	650	-	-	V	
Collector-emitter saturation voltage	V _{CE(sat)}	I _C = 40A, V _{GE} = 15V	T _{vj} = 25°C	-	1.8	2.3	V
			T _{vj} = 175°C	-	2.3	-	
Diode forward voltage	V _F	V _{GE} = 0V, I _F = 20A	T _{vj} = 25°C	-	1.5	1.95	V
			T _{vj} = 175°C	-	1.5	-	
Gate-emitter threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 40mA	3.5	5.0	6.5	V	
Zero gate voltage collector current	I _{CES}	V _{CE} = 650V, V _{GE} = 0V, T _{vj} = 25°C	-	-	40	μA	
Gate-emitter leakage current	I _{GES}	V _{GE} = 20V, V _{CE} = 0V	-	-	±100	nA	
Dynamic Characteristic							
Total gate charge	Q _g	V _{CE} = 520V, I _C = 40A, V _{GE} = 15V	-	60	-	nC	
Gate-emitter charge	Q _{ge}		-	13	-		
Gate-collector charge	Q _{gc}		-	25	-		
Input capacitance	C _{ies}	V _{CE} = 25V, V _{GE} = 0V, f = 1MHz	-	1565	-	pF	
Reverse transfer capacitance	C _{res}		-	37	-		
Output capacitance	C _{oes}		-	120	-		
Switching Characteristic							
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 40A, R _G = 10Ω, Inductive Load, T _{vj} = 25°C	-	6	-	ns	
Rise time	t _r		-	36	-		
Turn-off delay time	t _{d(off)}		-	55	-		
Fall time	t _f		-	64	-	mJ	
Turn-on switching energy	E _{on}		-	0.5	-		
Turn-off switching energy	E _{off}		-	0.4	-		
Total switching energy	E _{ts}	-	0.9	-	ns		
Turn-on delay time	t _{d(on)}	V _{GE} = 15V, V _{CC} = 400V, I _C = 40A, R _G = 10Ω, Inductive Load, T _{vj} = 175°C	-	7		-	
Rise time	t _r		-	41		-	
Turn-off delay time	t _{d(off)}		-	60		-	
Fall time	t _f		-	102		-	mJ
Turn-on switching energy	E _{on}		-	1.04		-	
Turn-off switching energy	E _{off}		-	0.57	-		
Total switching energy	E _{ts}	-	1.61	-	ns		
Reverse recovery time	t _{rr}	I _F = 20A, di _F /dt = 820A/μs, T _{vj} = 25°C	-	60		-	
Reverse recovery current	I _{rr}		-	18		-	A
Reverse recovery charge	Q _{rr}		-	696		-	nC
Reverse recovery time	t _{rr}	I _F = 20A, di _F /dt = 820A/μs, T _{vj} = 175°C	-	72		-	ns
Reverse recovery current	I _{rr}		-	22		-	A
Reverse recovery charge	Q _{rr}		-	864	-	nC	

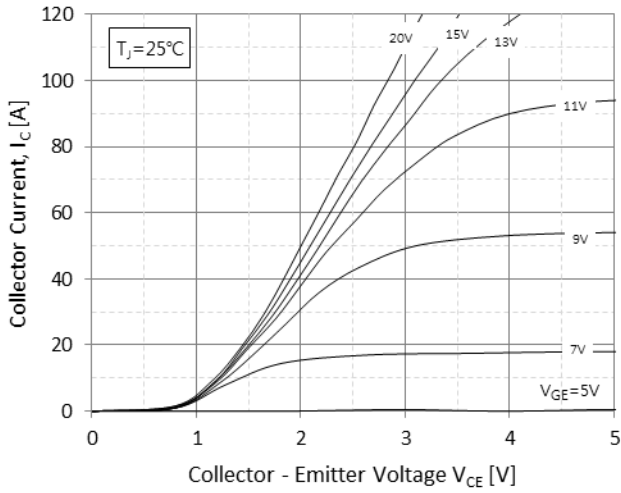


Fig.1 Typical Output Characteristics($T_J=25^\circ\text{C}$)

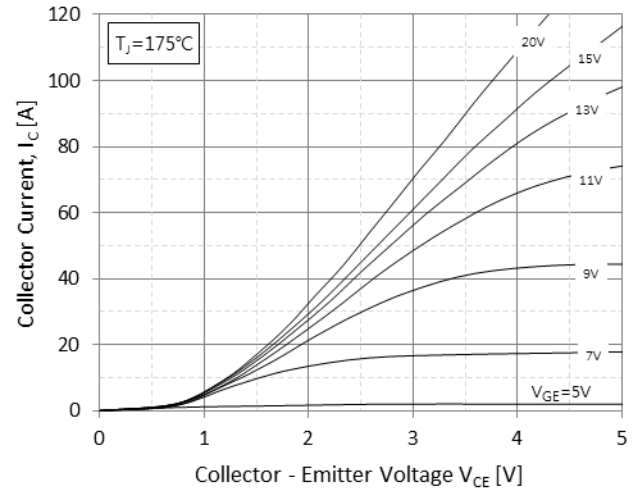


Fig.2 Typical Output Characteristics($T_J=175^\circ\text{C}$)

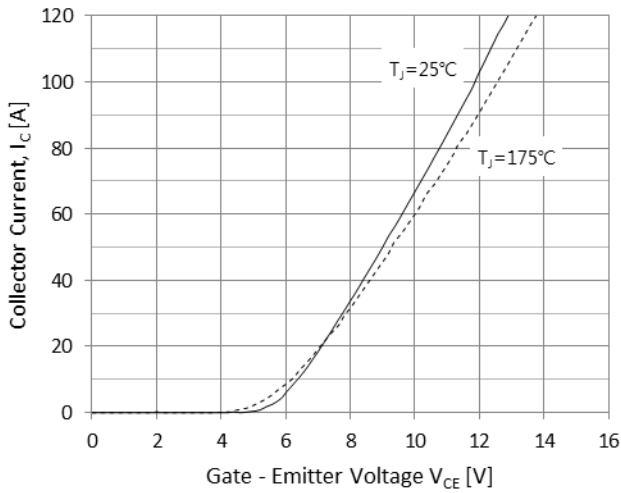


Fig.3 Typical Transfer Characteristics

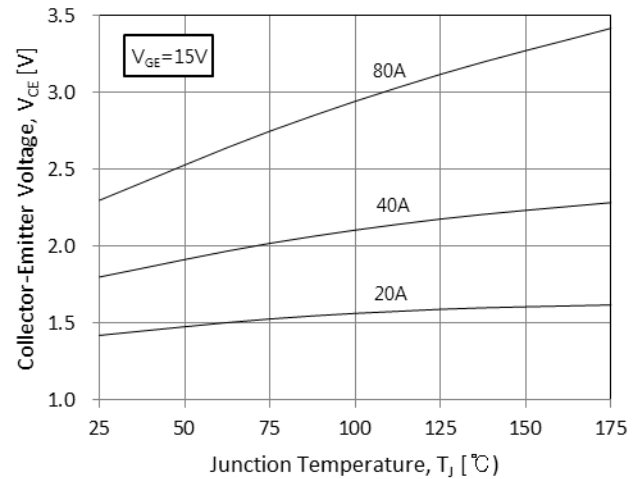


Fig.4 Typical Collector-Emmitter Saturation Voltage - Junction Temperature

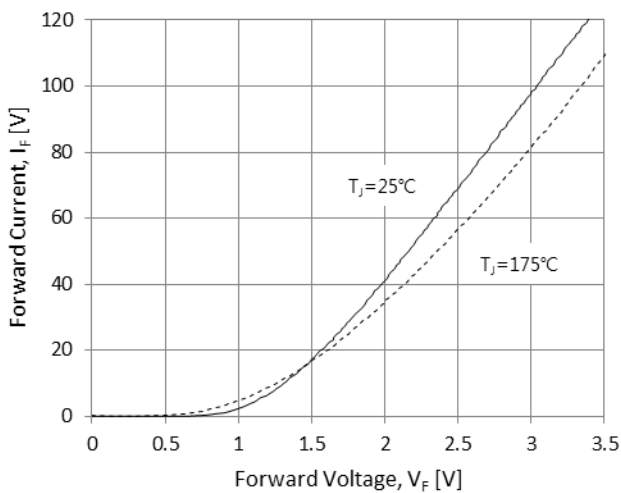


Fig.5 Diode Forward Characteristics

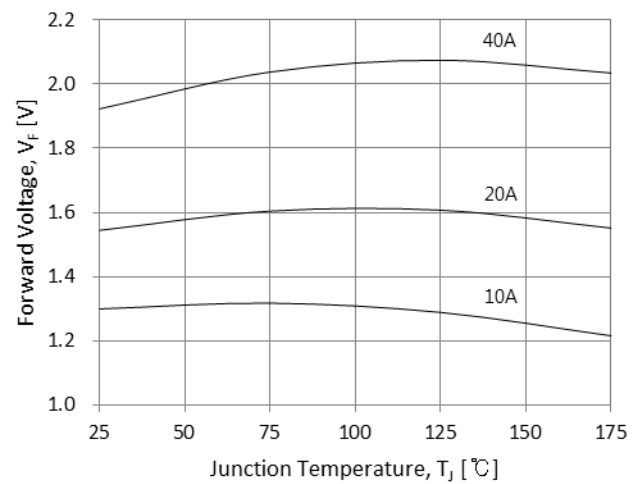


Fig.6 Diode Forward-Junction Temperature

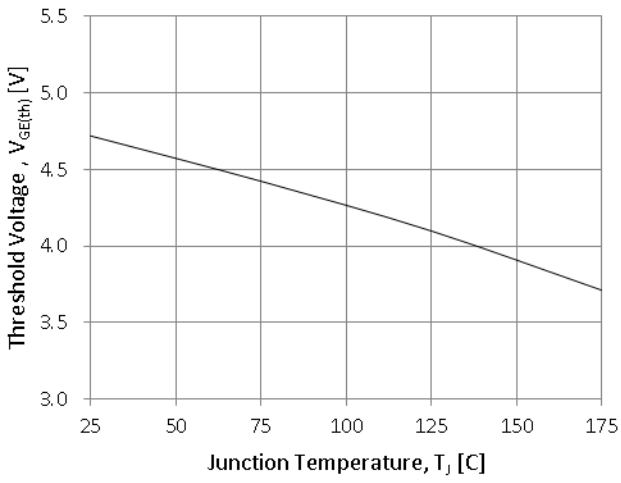


Fig.7 Threshold Voltage-Junction Temperature

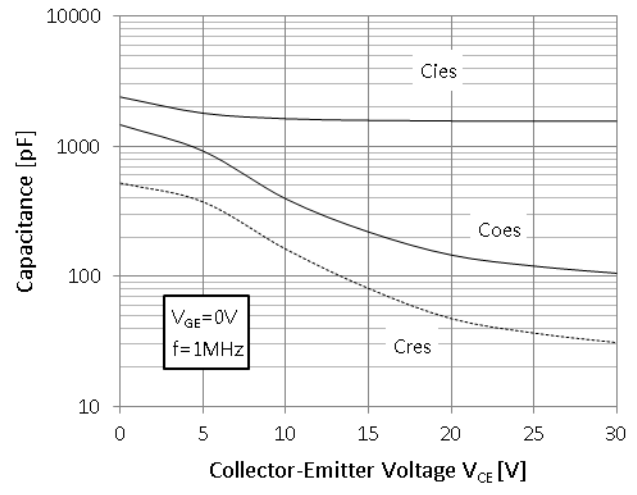


Fig.8 Typical Capacitance

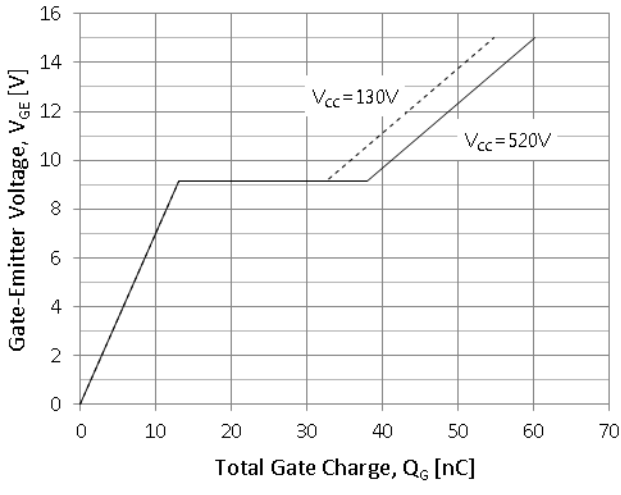


Fig.9 Typical Gate Charge

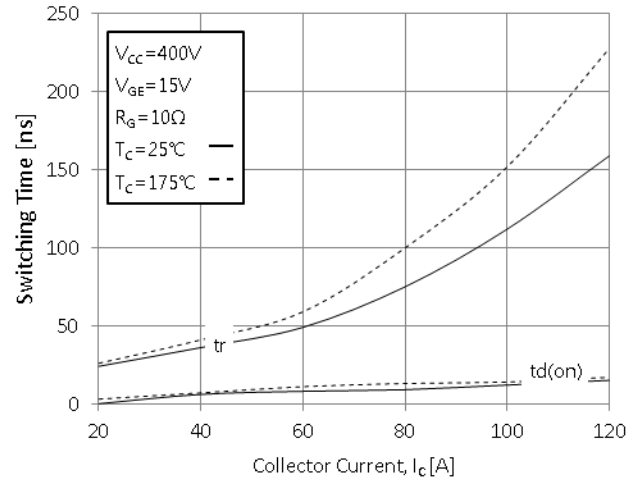


Fig.10 Typical Turn on-Collector Current

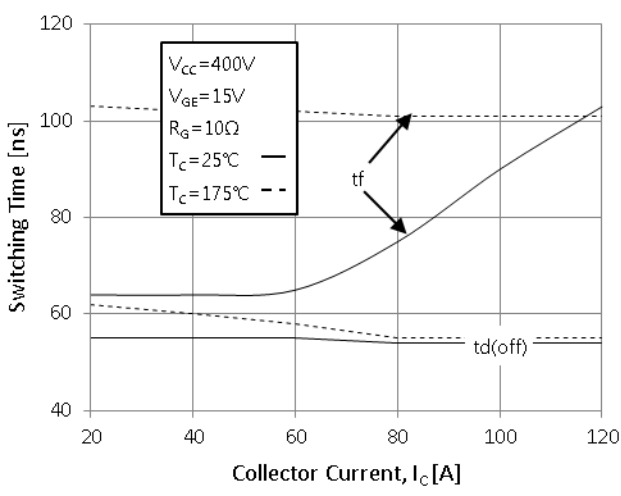


Fig.11 Typical Turn off-Collector Current

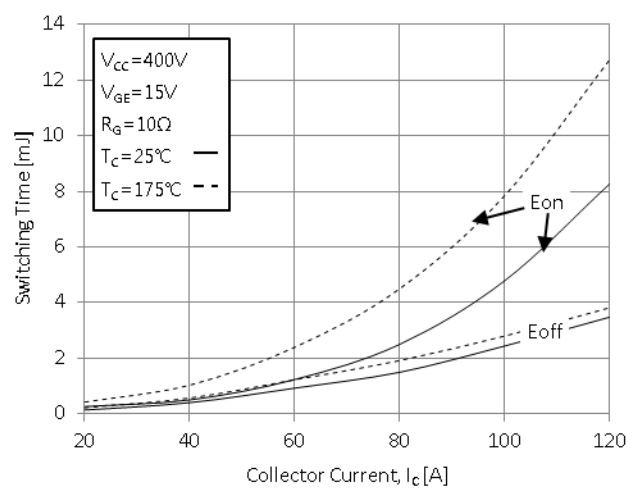


Fig.12 Switching Loss-Collector Current

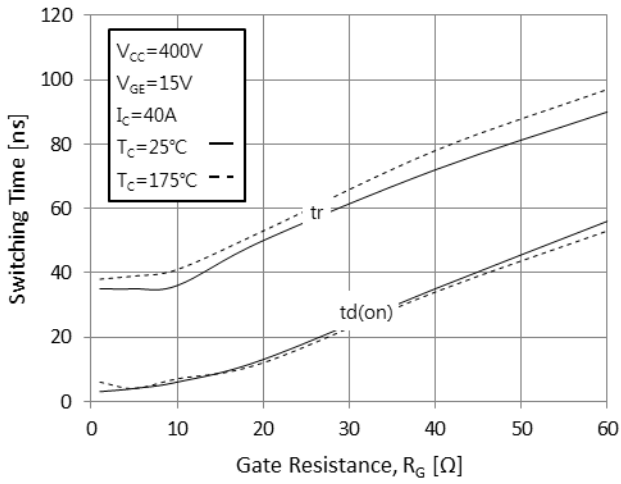


Fig.13 Turn on Characteristics-Gate Resistance

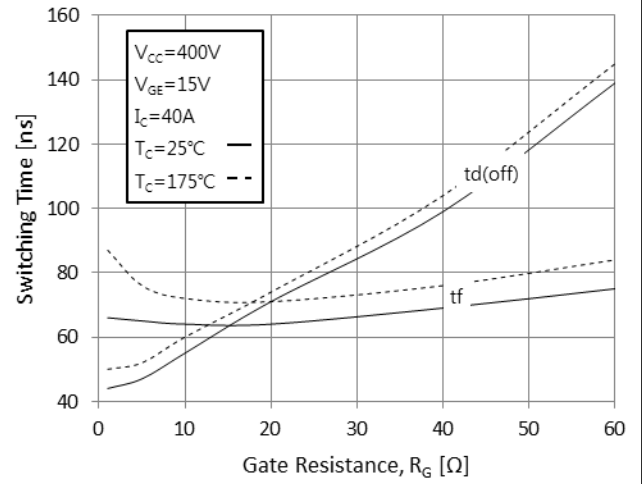


Fig.14 Turn off Characteristics-Gate Resistance

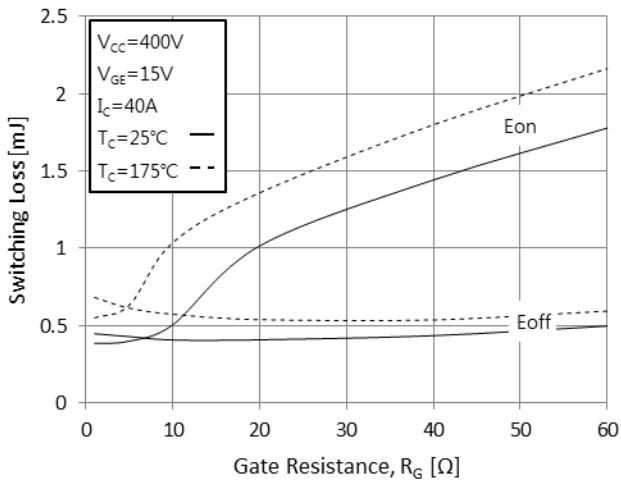


Fig.15 Switching Loss-Gate Resistance

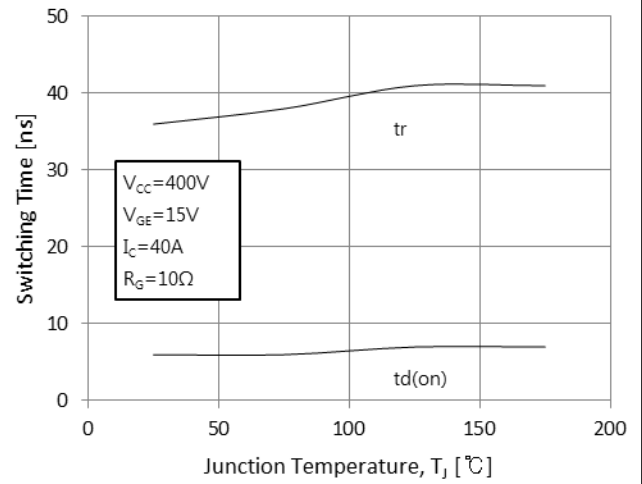


Fig.16 Turn on Characteristics-Junction Temperature

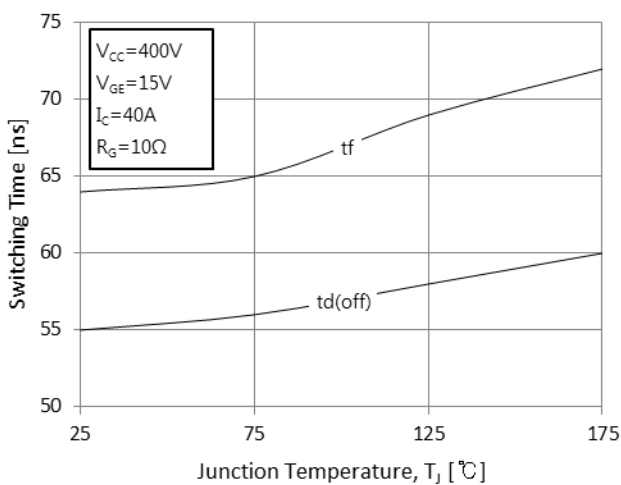


Fig.17 Turn off Characteristics-Junction Temperature

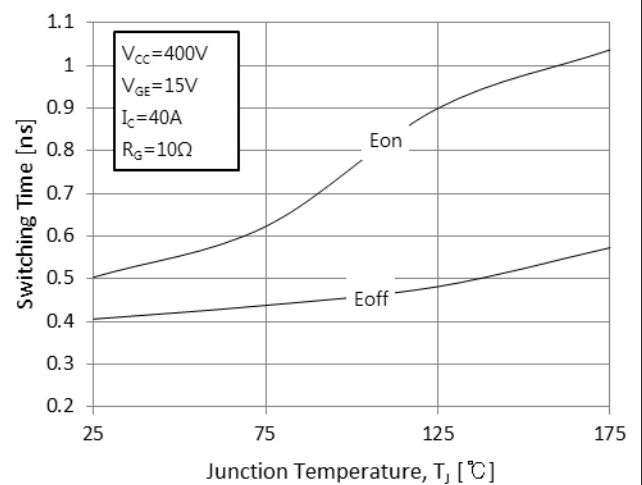


Fig.18 Switching Loss-Junction Temperature

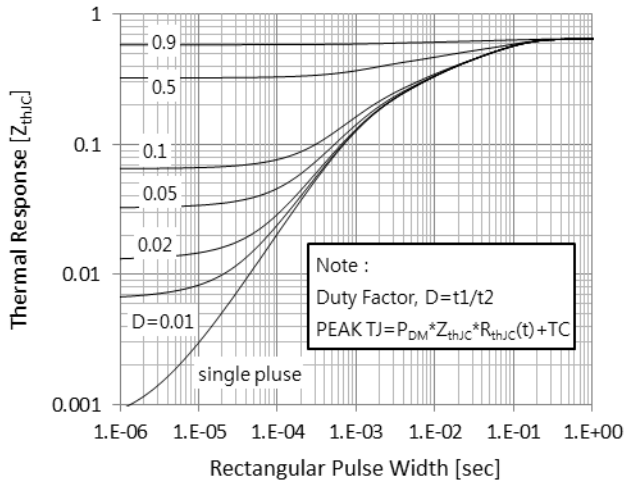


Fig.19 IGBT Transient Thermal Impedance

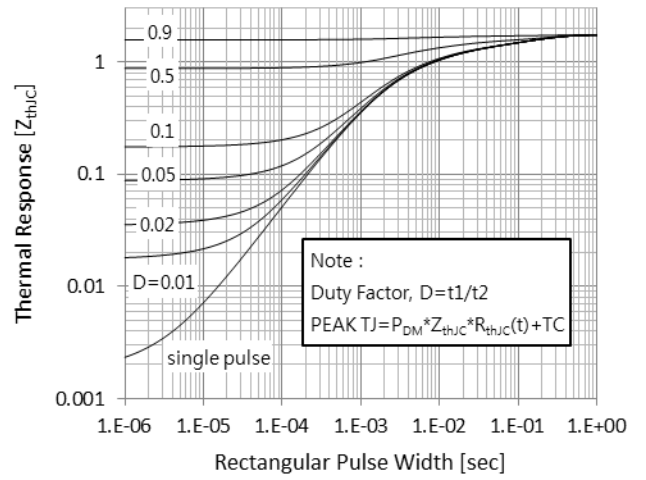
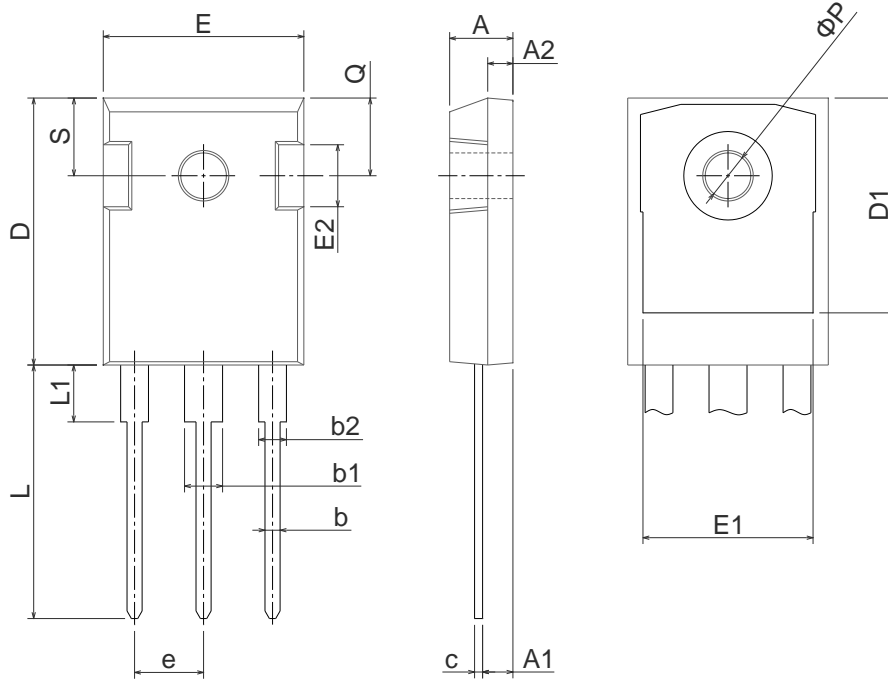


Fig.20 FRD Transient Thermal Impedance

Physical Dimension

TO-247

Dimensions are in millimeters, unless otherwise specified




Dimension	Min(mm)	Max(mm)
A	4.70	5.31
A1	2.20	2.60
A2	1.50	2.49
b	0.99	1.40
b1	2.59	3.43
b2	1.65	2.39
c	0.38	0.89
D	20.30	21.46
D1	13.08	-
E	15.45	16.26
E1	13.06	14.02
E2	4.32	5.49
e	5.45BSC	
L	19.81	20.57
L1	-	4.50
ΦP	3.50	3.70
Q	5.38	6.20
S	6.15BSC	

Note : Package body size, length and width do not include mold flash, protrusions and gate burrs.

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