

# RBN40H125S1FPQ-A0

1250V - 40V - IGBT  
Power Switching

R07DS1380EJ0140  
Rev.1.40  
Aug.03.2020

## Features

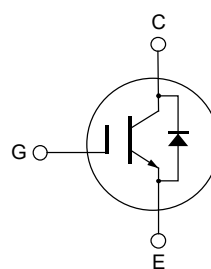
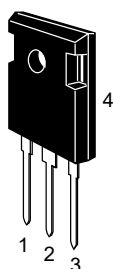
- Trench gate and thin wafer technology (G8H series)
- Built in fast recovery diode in one package
- Low collector to emitter saturation voltage  
 $V_{CE(sat)} = 1.8 \text{ V typ. (at } I_C = 40 \text{ A, } V_{GE} = 15 \text{ V, } T_a = 25^\circ\text{C)}$
- Quality grade: Standard
- High speed switching
- Short circuit withstands time (10  $\mu\text{s min.}$ )
- Applications: UPS, Welding, photovoltaic inverters, Power converter system

## Key Performance

Type	$V_{CES}$	$I_C$	$V_{CE(sat)}$ , $T_C=25^\circ\text{C}$	$I_F$	$t_{sc}$	$T_J$
RBN40H125S1FPQ-A0	1250 V	40 A	1.8 V	25 A	10 $\mu\text{s}$	175 $^\circ\text{C}$

## Outline

RENESAS Package code: PRSS0003ZH-A  
(Package name: TO-247A)



1. Gate
2. Collector
3. Emitter
4. Collector

## Absolute Maximum Ratings

(T<sub>c</sub> = 25°C)

Item		Symbol	Ratings	Unit
Collector to emitter voltage		V <sub>CES</sub>	1250	V
Gate to emitter voltage		V <sub>GES</sub>	±30	V
Collector current	T <sub>c</sub> = 25 °C	I <sub>C</sub>	80	A
	T <sub>c</sub> = 100 °C	I <sub>C</sub>	40	A
Collector peak current		I <sub>C(peak)</sub> Notes1	160	A
Diode forward current	T <sub>c</sub> = 25 °C	I <sub>F</sub>	50	A
	T <sub>c</sub> = 100 °C	I <sub>F</sub>	25	A
Diode forward peak current		I <sub>F(peak)</sub> Notes1	160	A
Collector power dissipation		P <sub>C</sub> Notes2	319	W
Junction temperature		T <sub>J</sub> Notes2	175	°C
Storage temperature		T <sub>stg</sub>	–55 to +150	°C

Note: Continuous heavy condition (e.g. high temperature/voltage/current or high variation of temperature) may affect a reliability even if it is within the absolute maximum ratings. Please consider derating condition for appropriate reliability in reference Renesas Semiconductor Reliability Handbook (Recommendation for Handling and Usage of Semiconductor Devices) and individual reliability data.

Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%

2. Please use this device in the thermal conditions which the junction temperature does not exceed 175 °C.  
 Renesas IGBT Application Note is disclosed about reliability test and application condition up to 175 °C.

## Thermal Resistance Characteristics

(T<sub>c</sub> = 25°C)

Item	Symbol	Max. Value Notes3	Unit
Junction to case thermal resistance (IGBT)	R <sub>th(j-c)</sub>	0.47	°C/W
Junction to case thermal resistance (Diode)	R <sub>th(j-c)</sub>	1.61	°C/W

Notes: 3. Designed target value on Renesas measurement condition. (Not tested)

## Electrical Characteristics

(Tc = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Collector to emitter leakage current	ICES	—	—	200	μA	VCE = 1250 V, VGE = 0 V
Gate to emitter leakage current	IGES	—	—	±1	μA	VGE = ±30 V, VCE = 0 V
Gate to emitter threshold voltage	VGE(th)	5.3	—	7.1	V	VCE = 10 V, IC = 1.3 mA
Collector to emitter saturation voltage	VCE(sat)	—	1.8	2.34	V	IC = 40 A, VGE = 15V <sup>Notes4</sup>
Input capacitance	Cies	—	2330	—	pF	VCE = 25 V VGE = 0 V f = 1 MHz
Output capacitance	Coēs	—	120	—	pF	
Reverse transfer capacitance	Cres	—	18	—	pF	
Total gate charge	Qg	—	85	—	nC	VGE = 15 V VCE = 600 V IC = 40 A
Gate to emitter charge	Qge	—	25	—	nC	
Gate to collector charge	Qgc	—	44	—	nC	
Turn-on delay time	td(on)	—	25	—	ns	VCC = 600 V VGE = 15 V/–15 V IC = 40 A Rg = 10 Ω Tc = 25 °C Inductive load <sup>Notes5</sup>
Rise time	tr	—	11	—	ns	
Turn-off delay time	td(off)	—	124	—	ns	
Fall time	tf	—	67	—	ns	
Turn-on loss energy	Eon	—	2.0	—	mJ	
Turn-off loss energy	Eoff	—	1.4	—	mJ	
Total switching energy	Etotal	—	3.4	—	mJ	
Turn-on delay time	td(on)	—	26	—	ns	
Rise time	tr	—	13	—	ns	
Turn-off delay time	td(off)	—	152	—	ns	
Fall time	tf	—	106	—	ns	VCC = 600 V VGE = 15 V/–15 V IC = 40 A Rg = 10 Ω Tc = 150 °C Inductive load <sup>Notes5</sup>
Turn-on loss energy	Eon	—	3.3	—	mJ	
Turn-off loss energy	Eoff	—	2.5	—	mJ	
Total switching energy	Etotal	—	5.8	—	mJ	
Short circuit withstand time <sup>Notes6</sup>	tsc	10	—	—	μs	VCC ≤ 720 V, VGE = 15 V Tc ≤ 150 °C

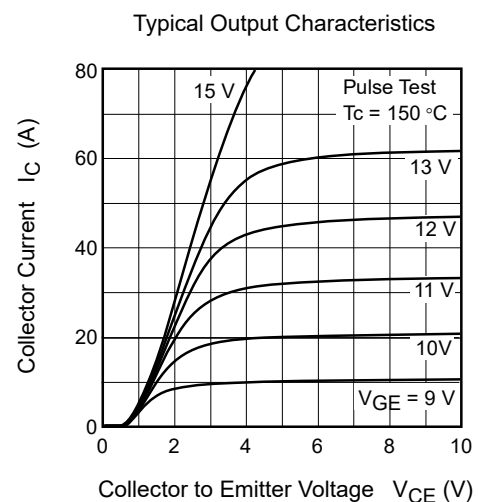
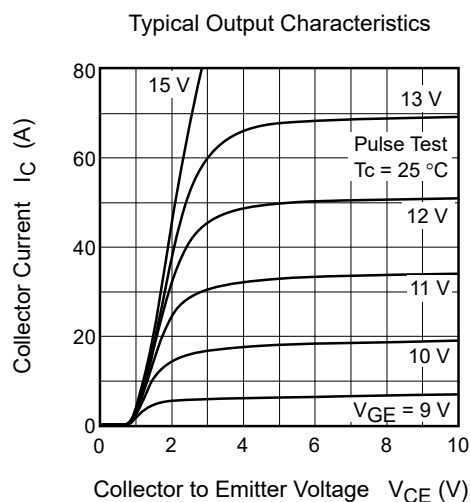
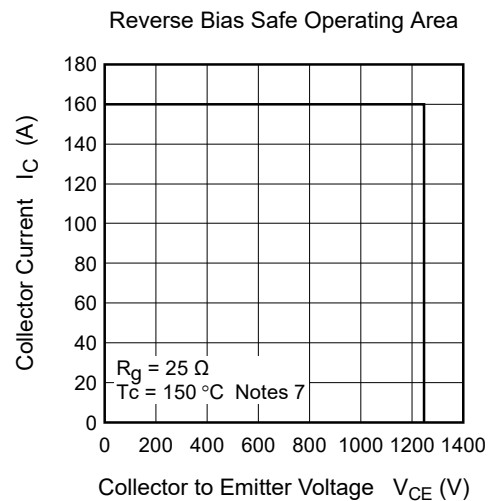
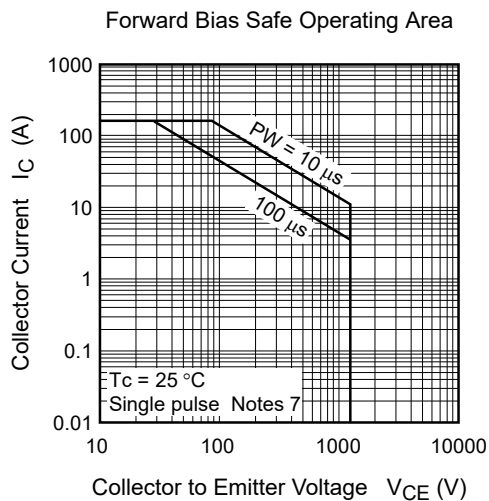
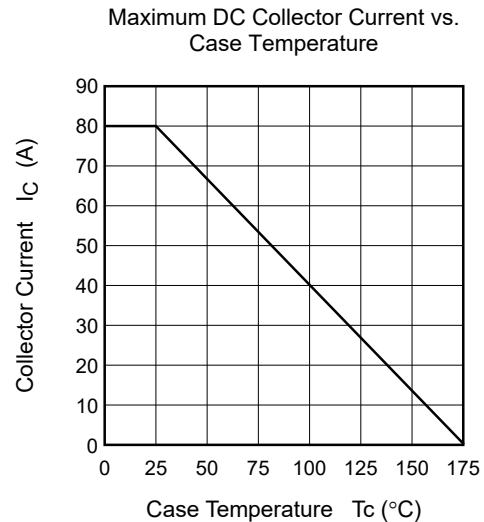
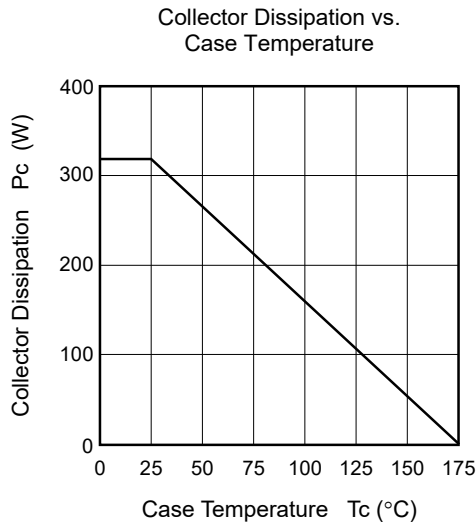
Diode forward voltage	VF	—	2.8	3.64	V	IF = 25 A <sup>Notes4</sup>
Diode reverse recovery time	trr	—	156	—	ns	IF = 25 A, dIF/dt = 300 A/μs
Diode reverse recovery charge	Qrr	—	0.92	—	μC	
Diode peak reverse recovery current	Irr	—	10	—	A	

Notes: 4. Pulse test

5. Switching time test circuit and waveform are shown below.

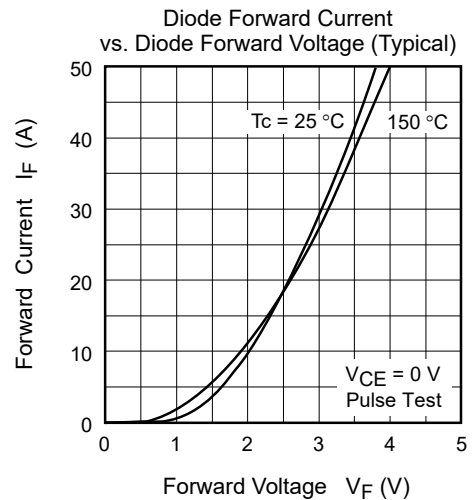
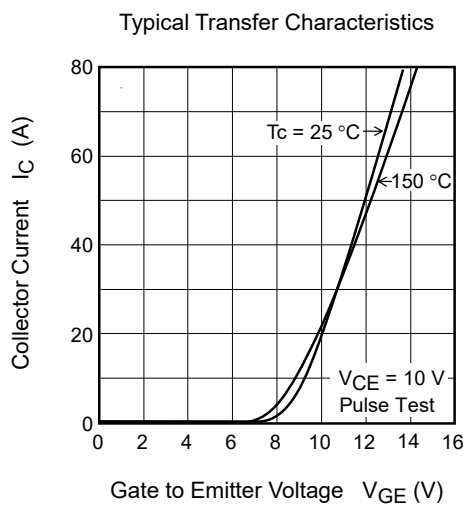
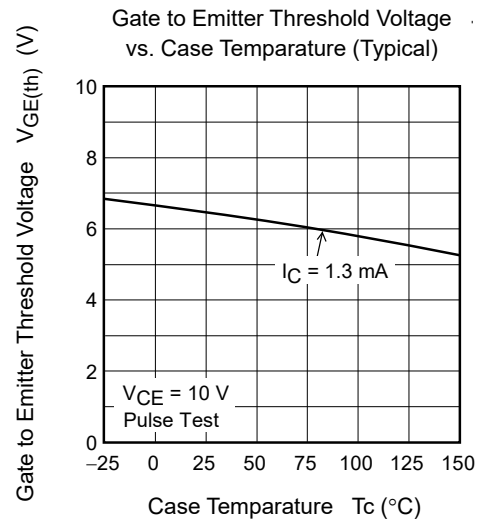
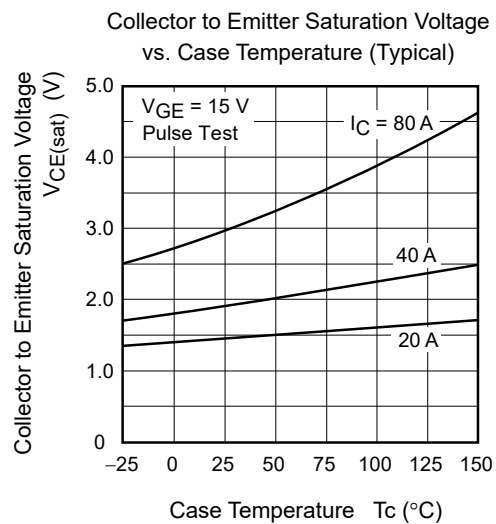
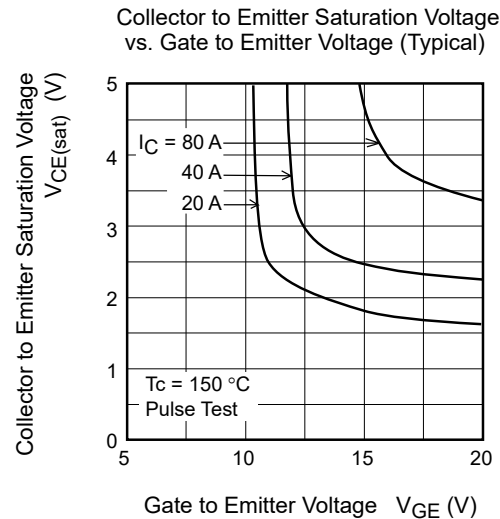
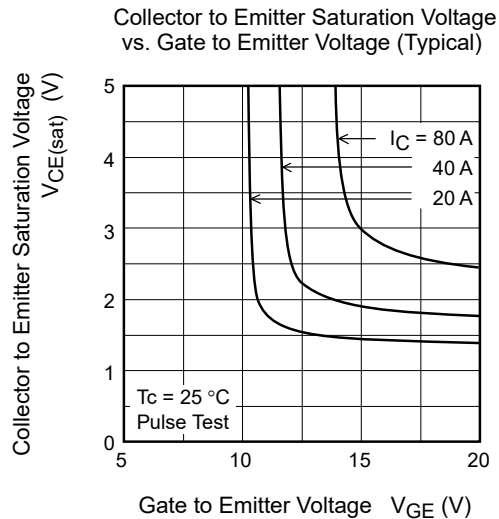
6. Designed target value on Renesas measurement condition. (Not tested)

## Main Characteristics

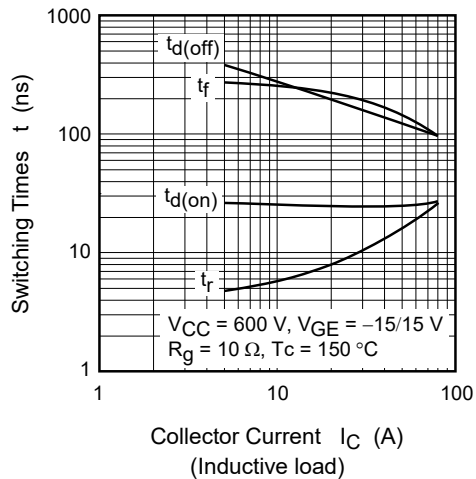


Notes: 7. Designed target value on Renesas measurement condition. (Not tested)

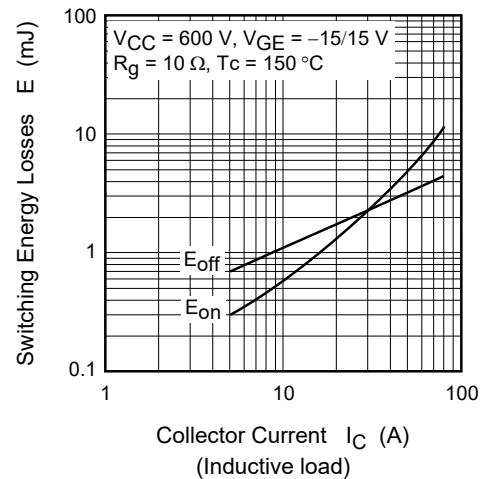
Renesas recommends that operating conditions are designed according to a document "Power MOS FET · IGBT Attention of Handling Semiconductor Devices".



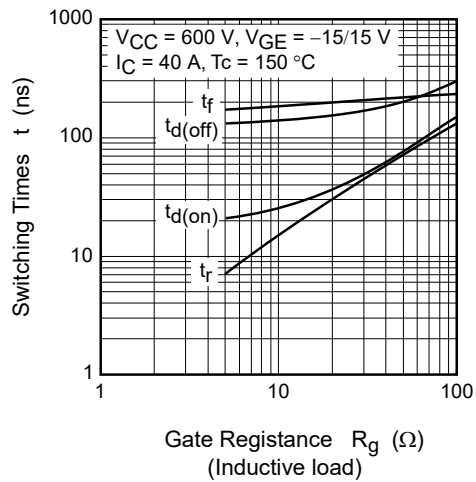
Switching Characteristics (Typical) (1)



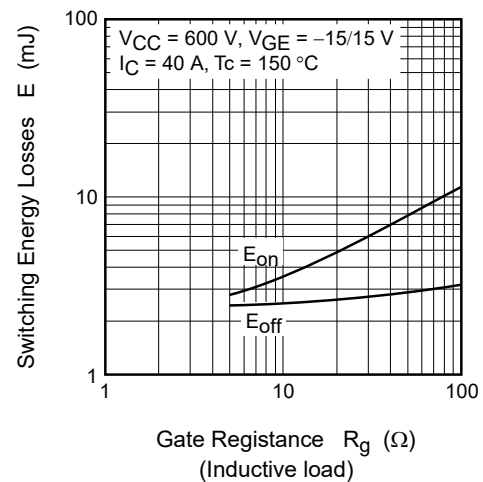
Switching Characteristics (Typical) (2)



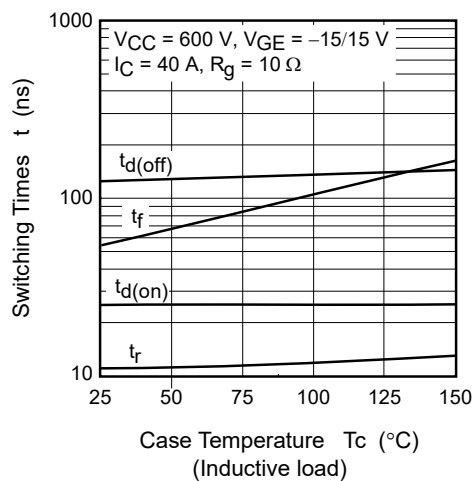
Switching Characteristics (Typical) (3)



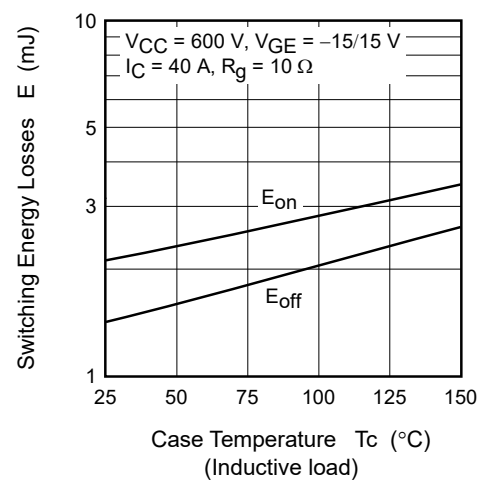
Switching Characteristics (Typical) (4)

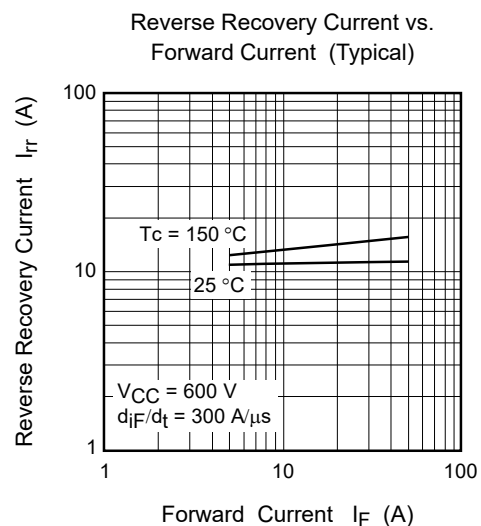
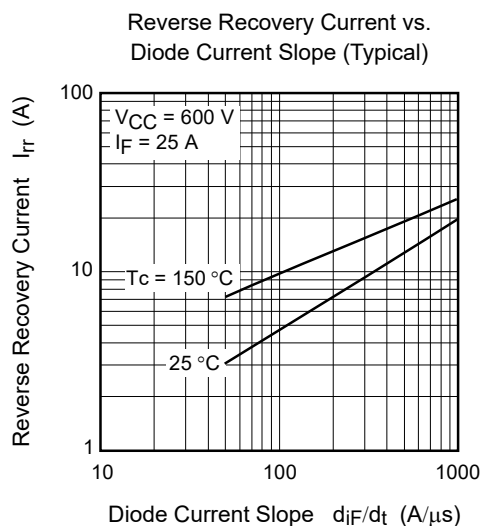
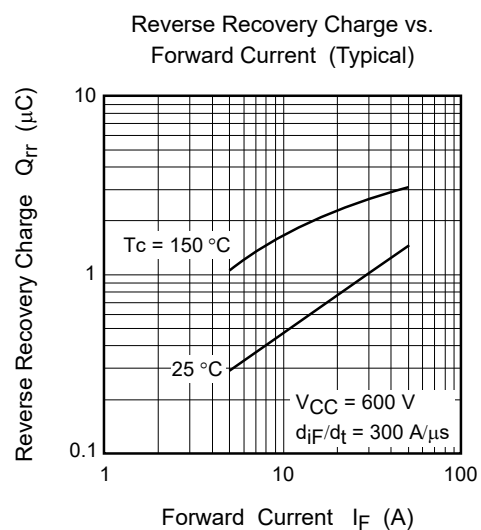
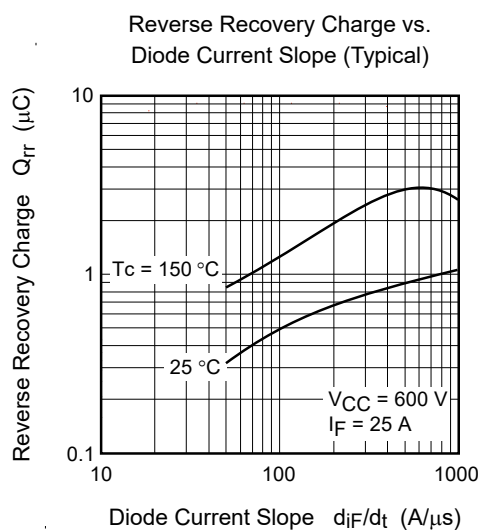
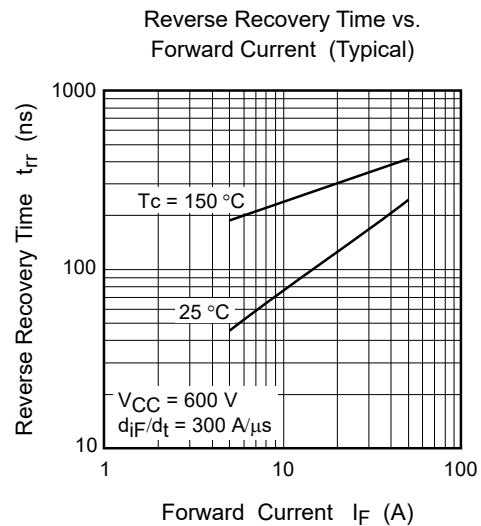
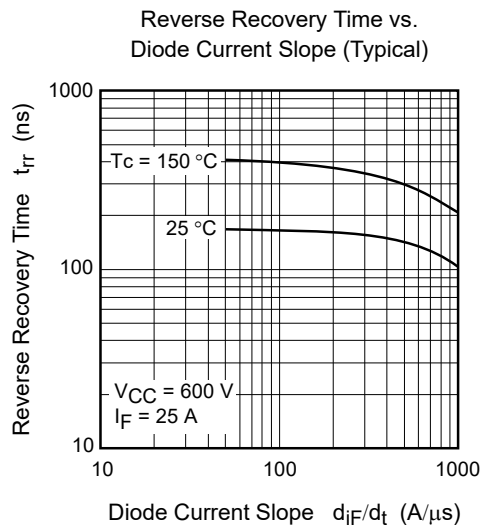


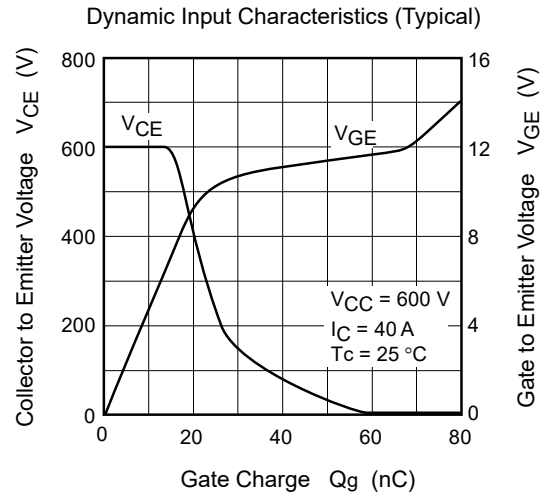
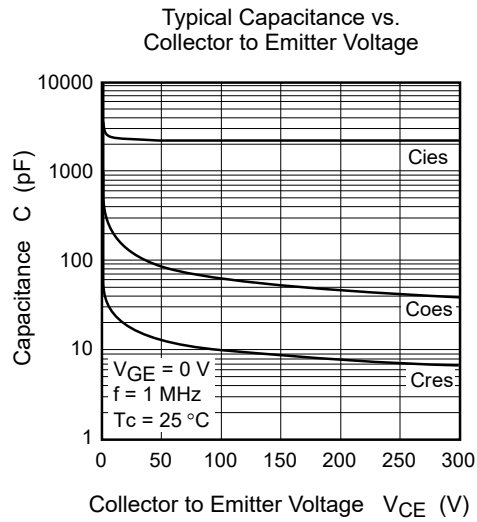
Switching Characteristics (Typical) (5)



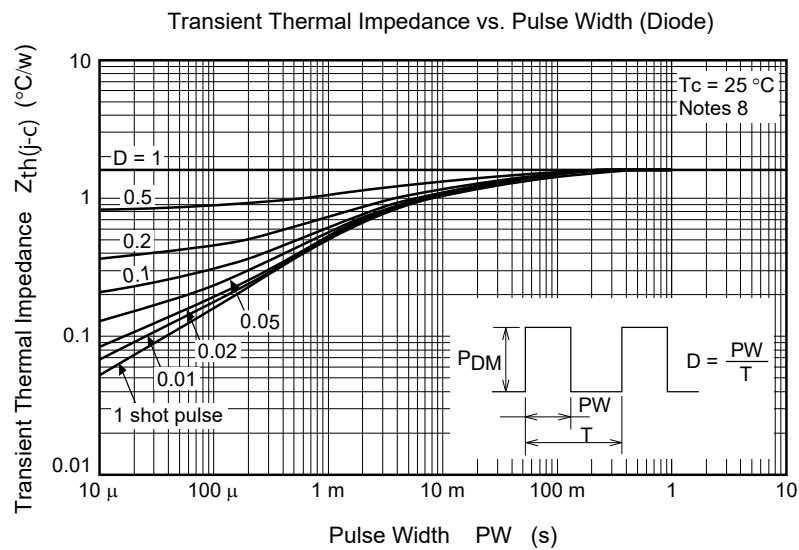
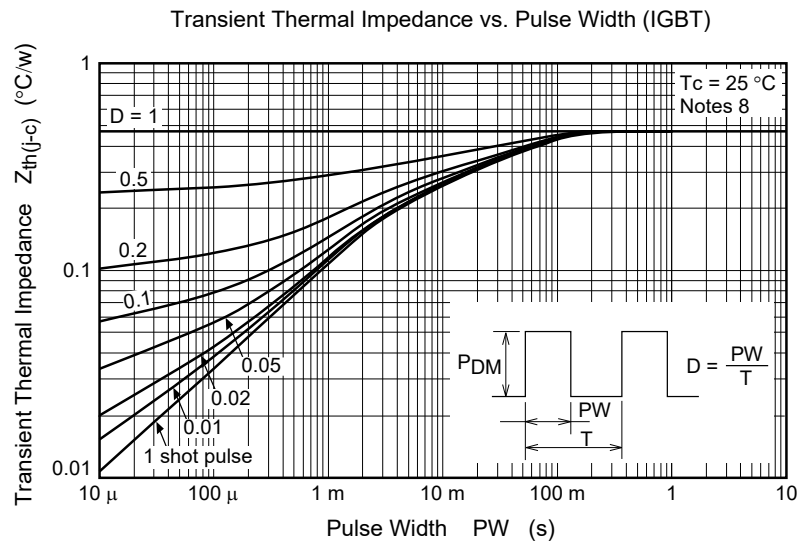
Switching Characteristics (Typical) (6)





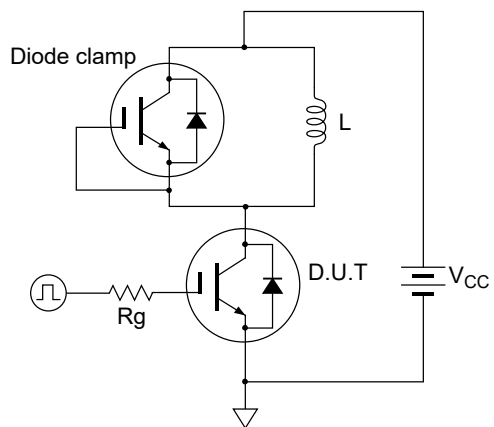




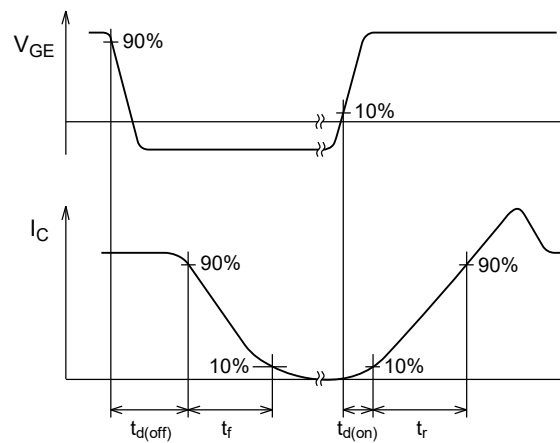


Notes: 8. Designed target value on Renesas measurement condition. (Not tested)

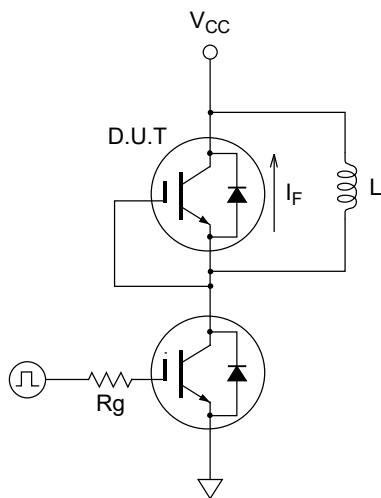
Switching Time Test Circuit



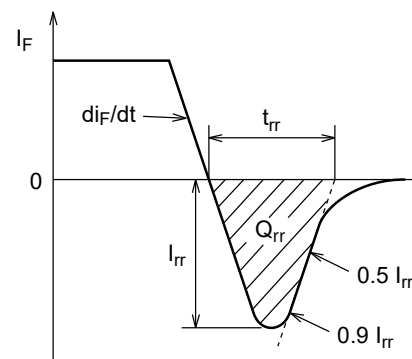
Waveform



Diode Reverse Recovery Time Test Circuit



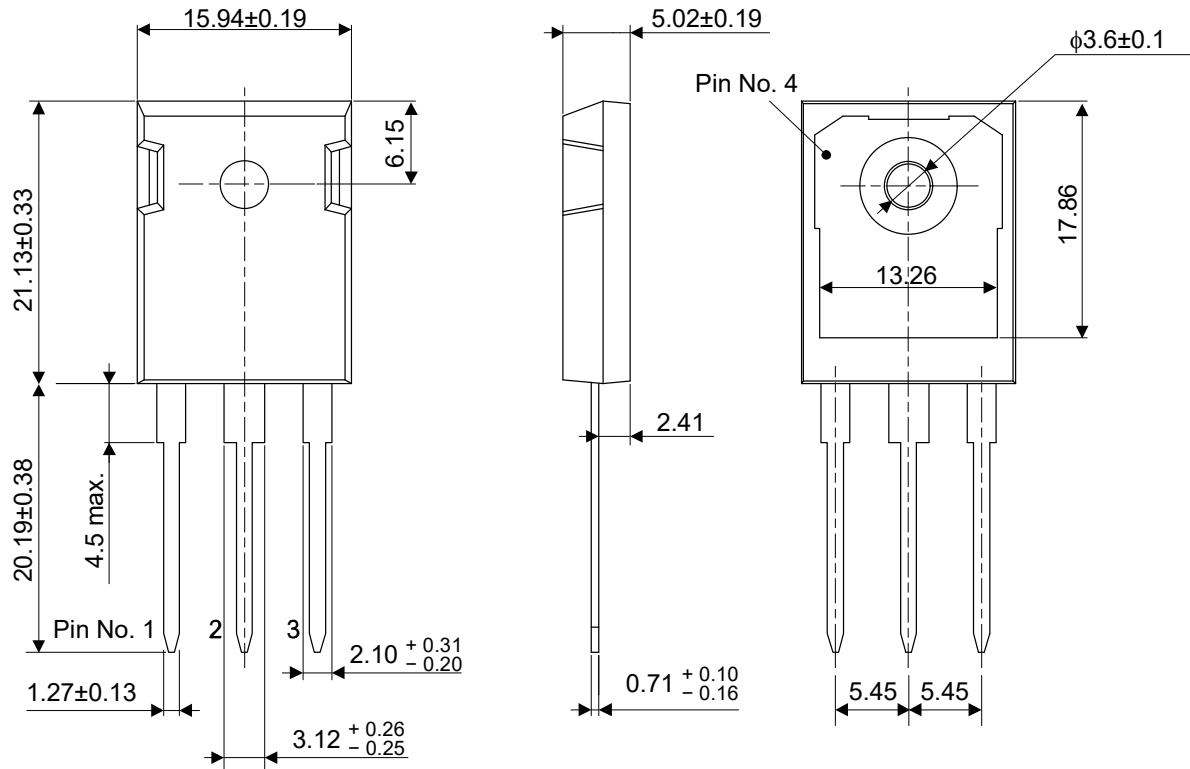
Waveform



## Package Dimensions

JEDEC Package Code	RENESAS Code	Previous Code	MASS (Typ) [g]
TO-247AD	PRSS0003ZH-A	—	6.14

Unit: mm



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## Ordering Information

Orderable Part Number	Quantity	Shipping Container
RBN40H125S1FPQ-A0#CB0	240 pcs	Box (Tube)

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