RJH65T04BDPM-A0

650V - 30A - IGBT
Application: Power Factor Correction circuit

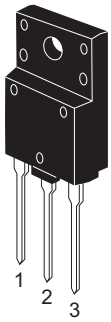
R07DS1366EJ0100
Rev.1.00
Jul 14, 2016

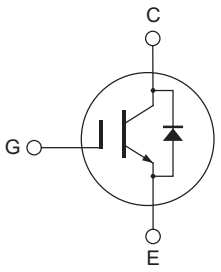
Features

- Low collector to emitter saturation voltage
  $V_{CE(sat)}$ = 1.5 V typ. (at I_C = 30 A, V_{GE} = 15 V, Ta = 25°C)
- Built in fast recovery diode in one package
- Trench gate and thin wafer technology
- High speed switching
  t_f = 45 ns typ. (at V_{CC} = 400 V, V_{GE} = 15 V, I_C = 30 A, Rg = 10 Ω, Ta=25°C , inductive load)
- Operation frequency (20kHz ≤ f < 40kHz)

Outline

RENESAS Package code: PRSS0003ZP-A
(Package name: TO-3PFP)





1. Gate
2. Collector
3. Emitter

Absolute Maximum Ratings

(Tc = 25°C)

Item		Symbol	Ratings	Unit
Collector to emitter voltage / diode reverse voltage		V_{CES} / V_R	650	V
Gate to emitter voltage		V_{GES}	±30	V
Collector current	Tc = 25°C	I_C	60	A
	Tc = 100°C	I_C	30	A
Collector peak current		ic(peak) Note1	120	A
Clamped inductive load current		I_{CL} Note2	120	A
Collector to emitter diode forward current	Tc = 25°C	I_{DF}	100	A
	Tc = 100°C	I_{DF}	50	A
Peak surge forward current		IFSM Note3	230	A
Collector dissipation		P_C Note4	65	W
Junction to case thermal resistance (IGBT)		θj-c Note4	2.3	°C /W
Junction to case thermal resistance (Diode)		θj-cd Note4	2.35	°C /W
Junction temperature		Tj Note4	175	°C
Storage temperature		Tstg	–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 are 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.

Electrical Characteristics

(Ta = 25°C)

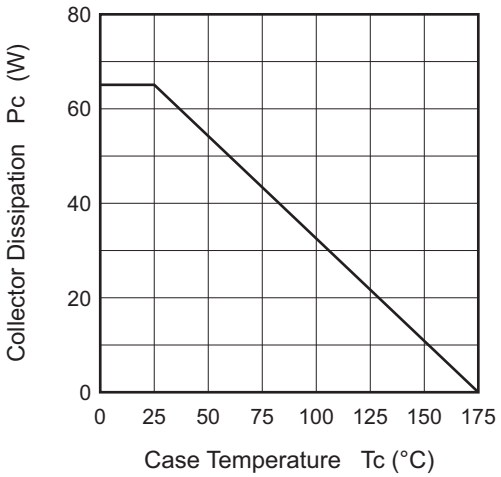
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero gate voltage collector current / Diode reverse current	I_{CES} / I_R	—	—	100	μA	V_{CE} = 650 V, V_{GE} = 0
Gate to emitter leak current	I_{GES}	—	—	±1	μA	V_{GE} = ±30 V, V_{CE} = 0
Gate to emitter cutoff voltage	$V_{GE(off)}$	4.0	—	7.0	V	V_{CE} = 10 V, I_C = 1 mA
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	1.50	1.95	V	I_C = 30 A, V_{GE} = 15 V Note5
Input capacitance	Cies	—	1760	—	pF	V_{CE} = 25 V V_{GE} = 0 f = 1 MHz
Output capacitance	Coes	—	125	—	pF	
Reverse transfer capacitance	Cres	—	34	—	pF	
Total gate charge	Qg	—	74	—	nC	V_{GE} = 15V V_{CE} = 400 V I_C = 30 A
Gate to emitter charge	Qge	—	13	—	nC	
Gate to collector charge	Qgc	—	31	—	nC	
Turn-on delay time	$t_{d(on)}$	—	35	—	ns	V_{CC} = 400 V V_{GE} = 15 V I_C = 30 A Rg = 10 Ω (Inductive load) Note6
Rise time	t_r	—	25	—	ns	
Turn-off delay time	$t_{d(off)}$	—	115	—	ns	
Fall time	t_f	—	45	—	ns	
Turn-on energy	E_{on}	—	0.36	—	mJ	
Turn-off energy	E_{off}	—	0.35	—	mJ	
Total switching energy	E_{total}	—	0.71	—	mJ	
Turn-on delay time	$t_{d(on)}$	—	35	—	ns	V_{CC} = 400 V V_{GE} = 15 V I_C = 30 A Rg = 10 Ω Tc = 150°C (Inductive load) Note6
Rise time	t_r	—	25	—	ns	
Turn-off delay time	$t_{d(off)}$	—	125	—	ns	
Fall time	t_f	—	70	—	ns	
Turn-on energy	E_{on}	—	0.60	—	mJ	
Turn-off energy	E_{off}	—	0.50	—	mJ	
Total switching energy	E_{total}	—	1.10	—	mJ	

FRD forward voltage	V_F	—	1.4	1.8	V	I_F = 30 A Note5
FRD forward voltage	V_F	—	1.7	2.2	V	I_F = 50 A Note5
FRD reverse recovery time	t_{rr}	—	80	—	ns	I_F = 50 A, di_F/dt = 300 A/μs
FRD reverse recovery charge	Q_{rr}	—	0.35	—	μC	
FRD peak reverse recovery current	I_{rr}	—	7.5	—	A	

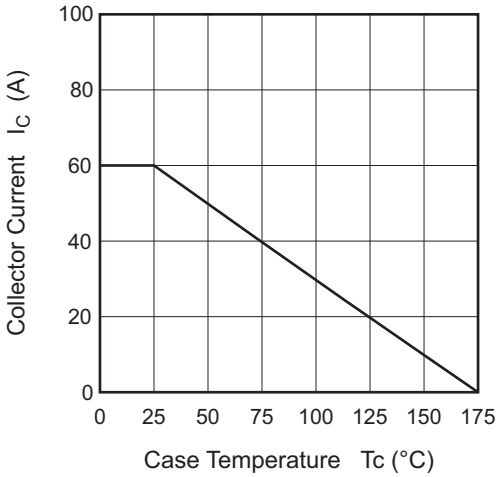
Notes: 1. PW ≤ 10 μs, duty cycle ≤ 1%
2. VGE = 15V
3. PW = 3ms (sine half wave, Non-repetitive,1 cycle), Tj=150degC
4. Please use this device in the thermal conditions which the junction temperature does not exceed 175°C
   Renesas IGBT Application Note is disclosed about reliability test and condition up to 175°C
5. Pulse test
6. Switching time test circuit and waveform are shown below.

Main Characteristics

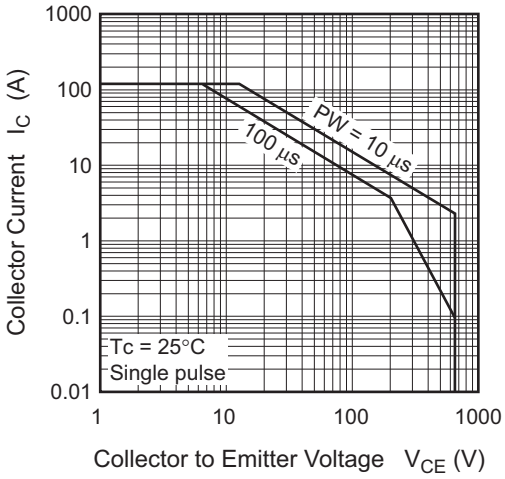
Collector Dissipation vs. Case Temperature



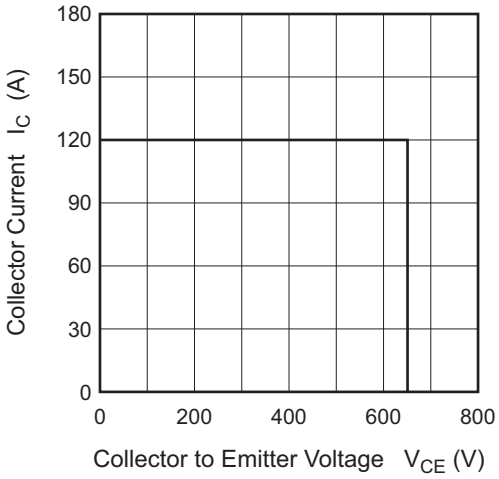
Maximum DC Collector Current vs. Case Temperature



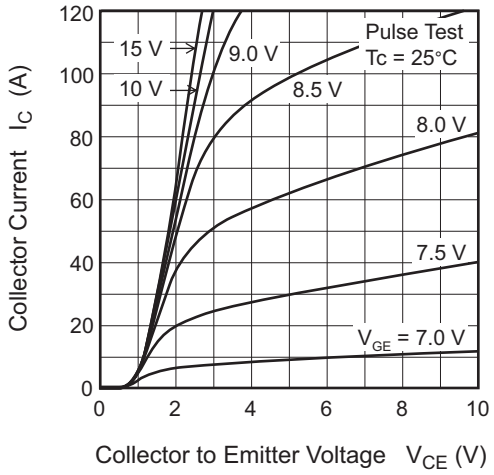
Maximum Safe Operation Area



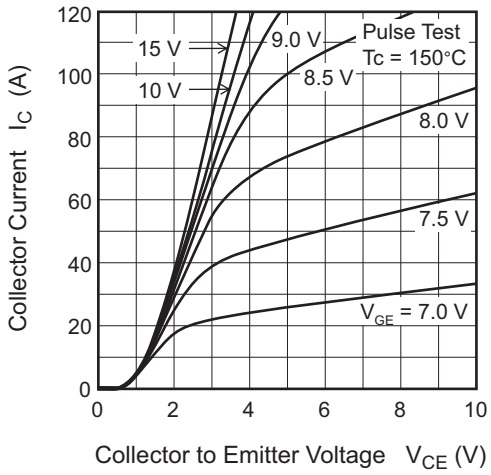
Turn-off SOA



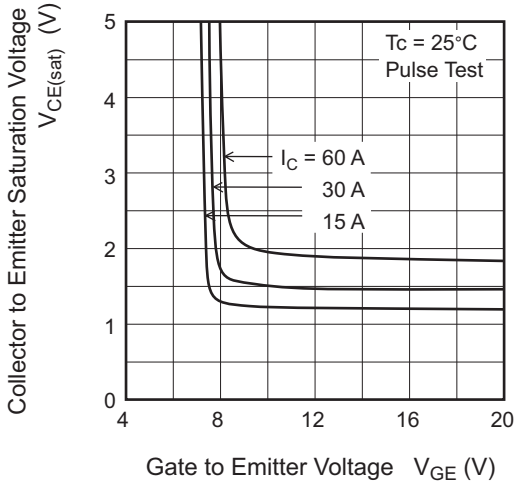
Typical Output Characteristics



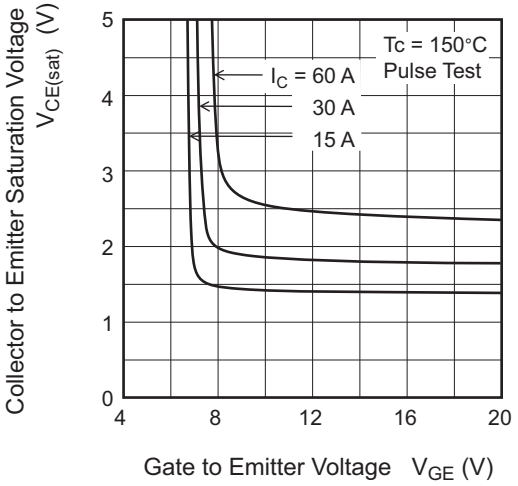
Typical Output Characteristics



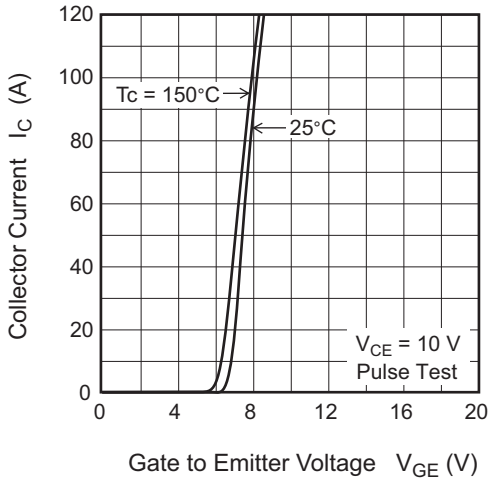
Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage (Typical)



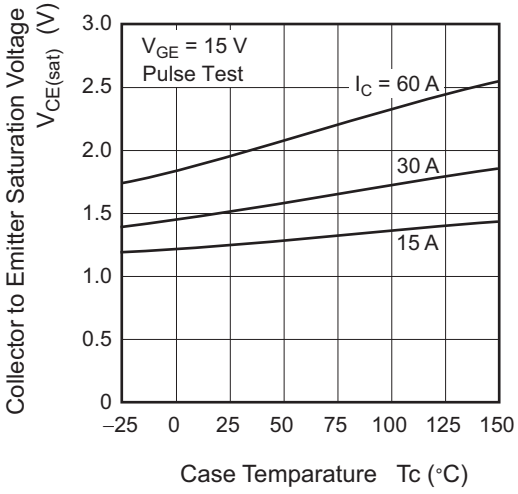
Collector to Emitter Saturation Voltage vs. Gate to Emitter Voltage (Typical)



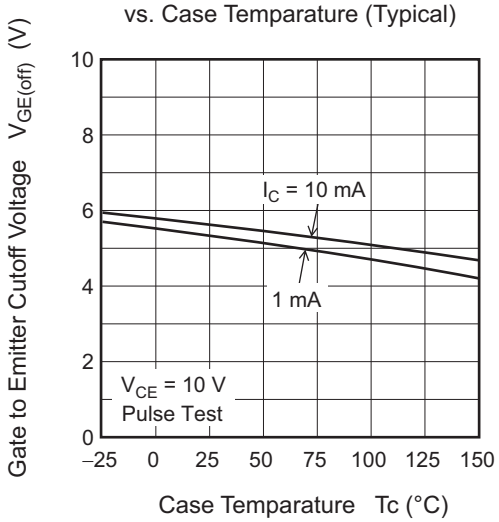
Typical Transfer Characteristics



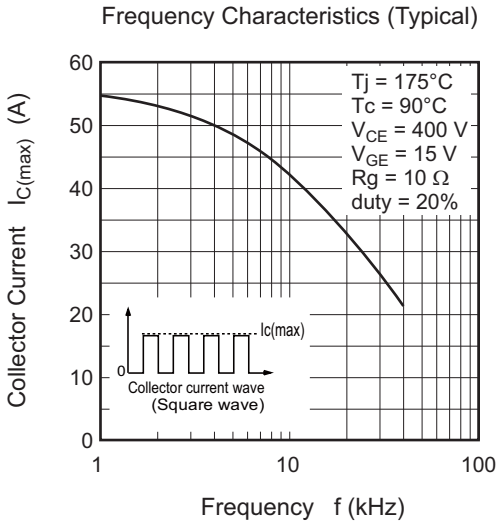
Collector to Emitter Saturation Voltage vs. Case Temparature (Typical)



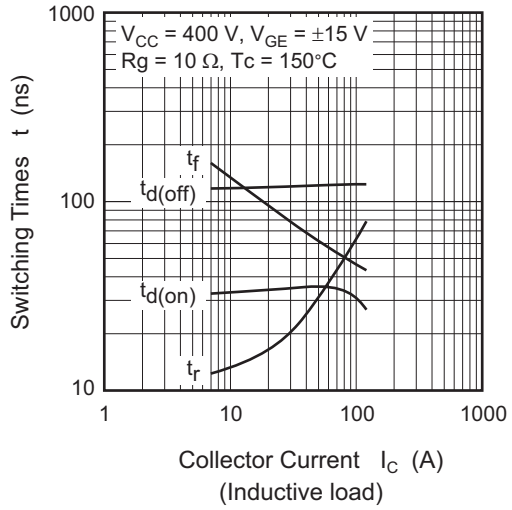
Gate to Emitter Cutoff Voltage vs. Case Temparature (Typical)



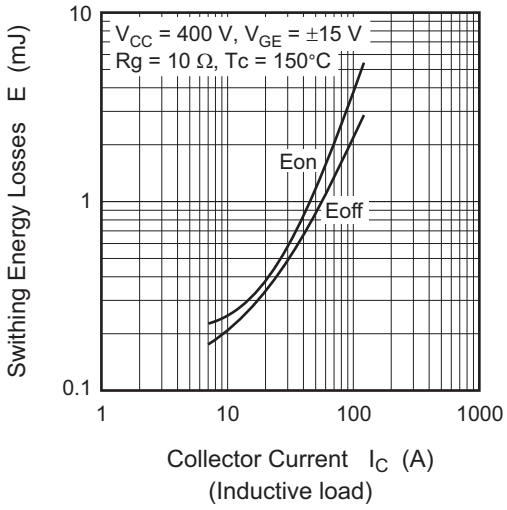
Frequency Characteristics (Typical)



Switching Characteristics (Typical) (1)



Switching Characteristics (Typical) (2)



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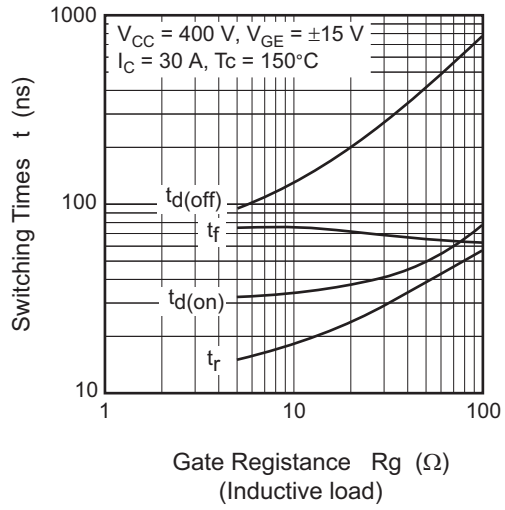
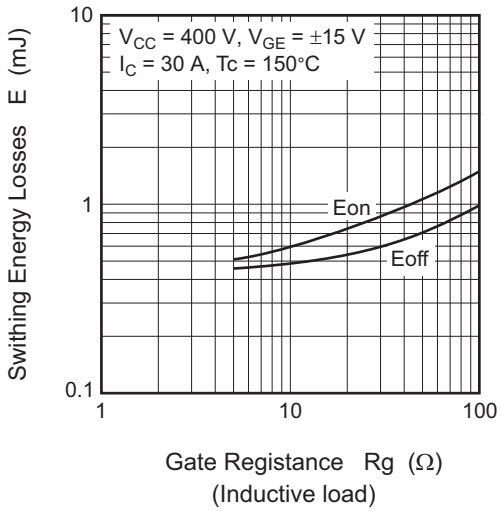
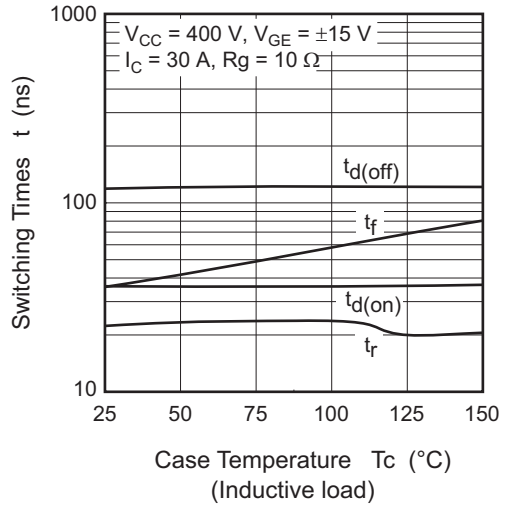


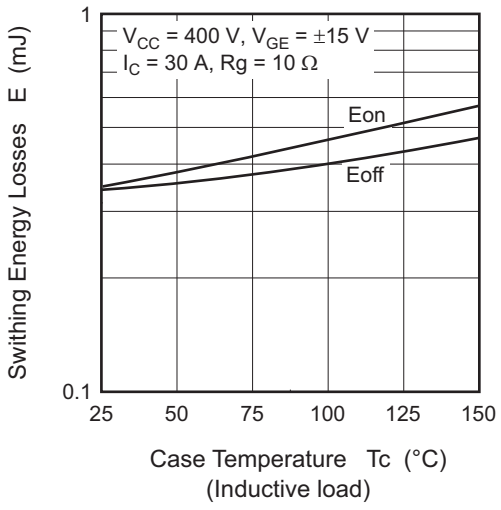
Switching Characteristics (Typical) (4)



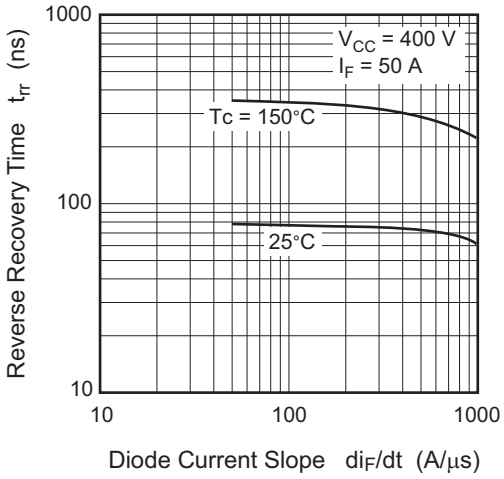
Switching Characteristics (Typical) (5)



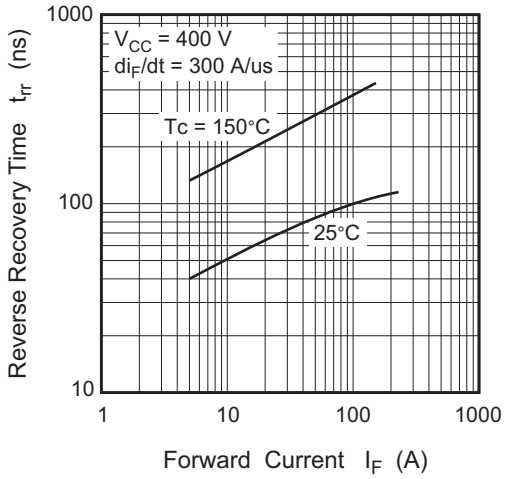
Switching Characteristics (Typical) (6)



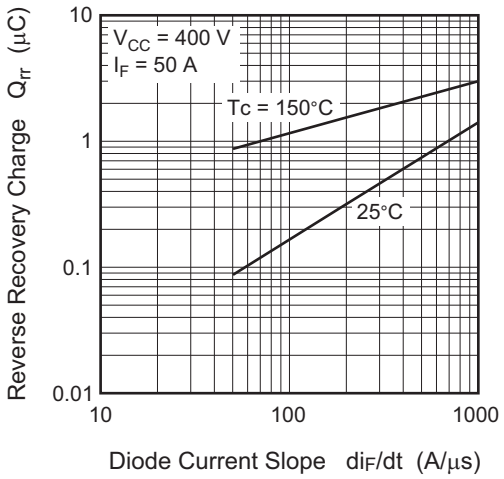
Reverse Recovery Time vs.
Diode Current Slope (Typical)



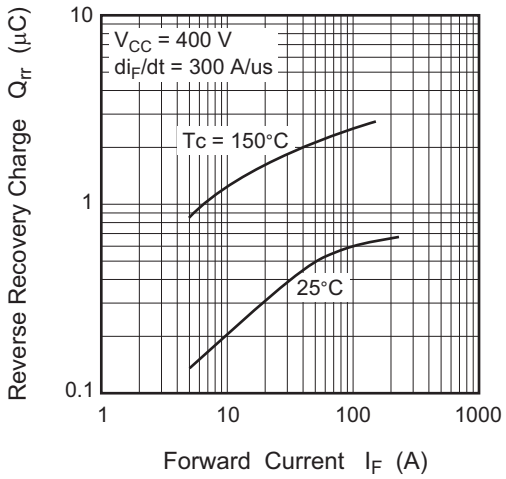
Reverse Recovery Time vs.
Forward Current (Typical)



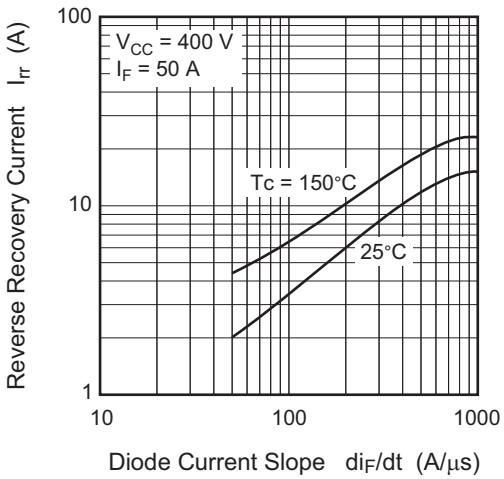
Reverse Recovery Charge vs.
Diode Current Slope (Typical)



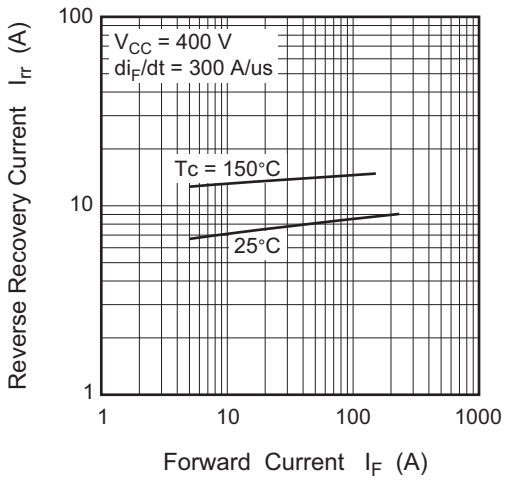
Reverse Recovery Charge vs.
Forward Current (Typical)



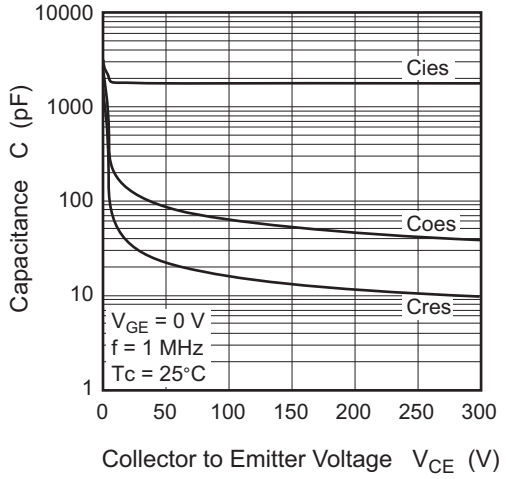
Reverse Recovery Current vs.
Diode Current Slope (Typical)



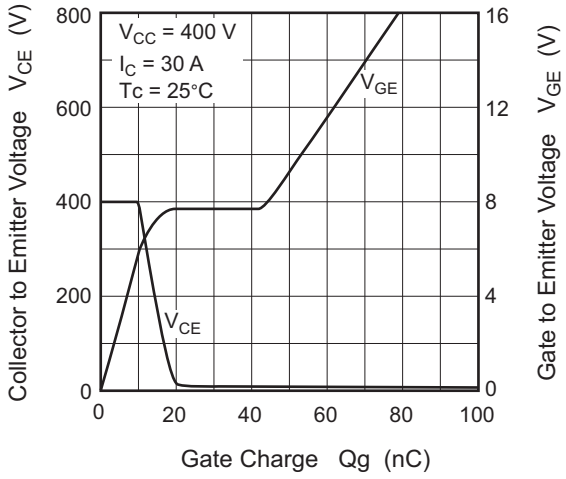
Reverse Recovery Current vs.
Forward Current (Typical)



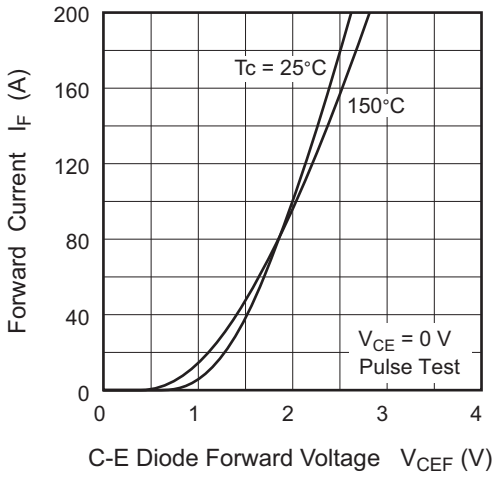
Typical Capacitance vs.
Collector to Emitter Voltage

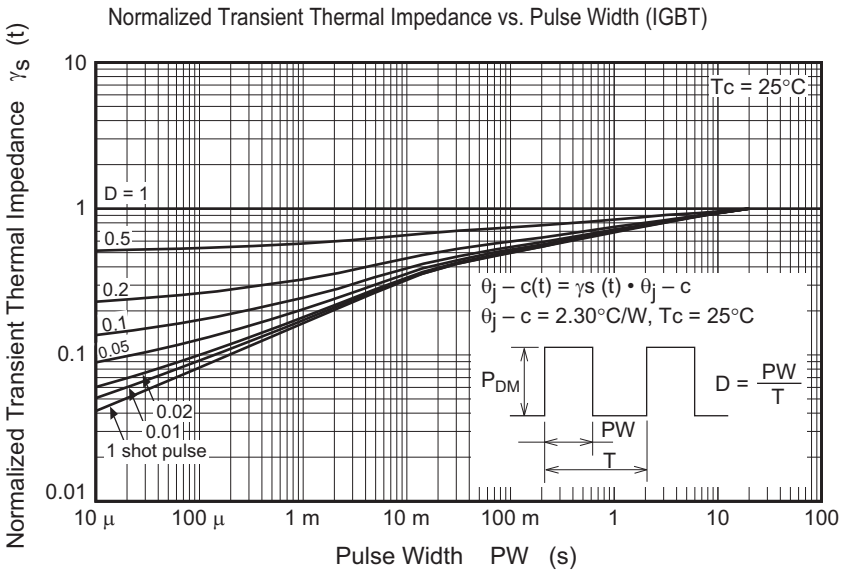


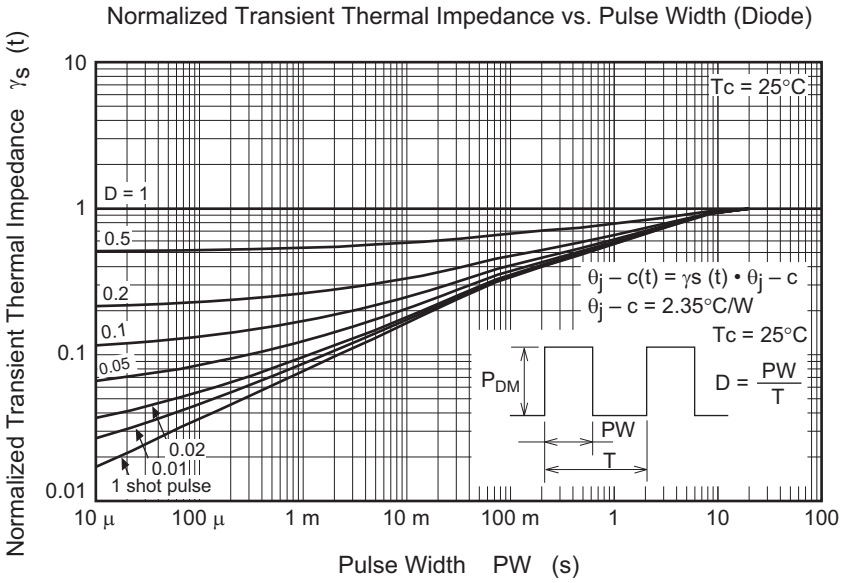
Dynamic Input Characteristics (Typical)



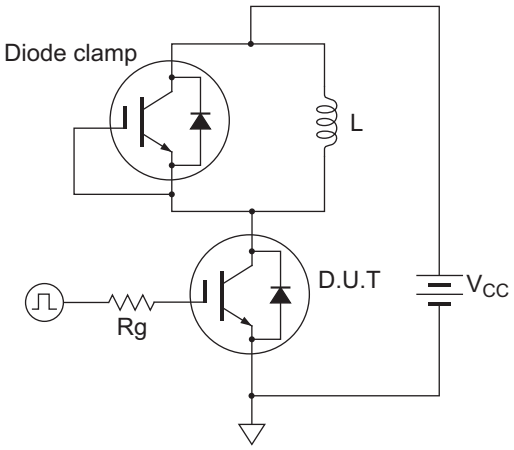
Forward Current vs. Forward Voltage (Typical)



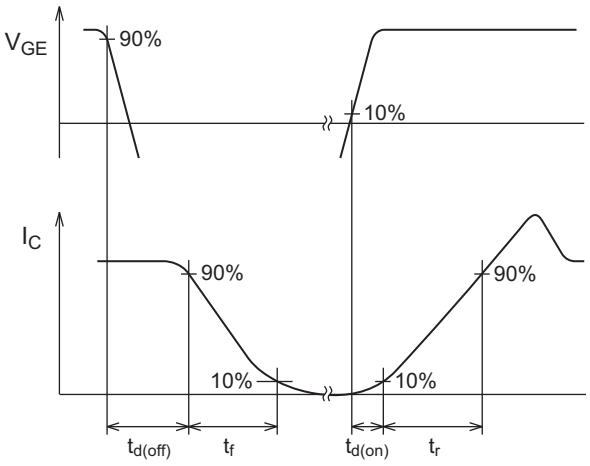

Normalized Transient Thermal Impedance vs. Pulse Width (IGBT)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1 shot pulse
θj – c(t) = γs (t) • θj – c
θj – c = 2.30°C/W, Tc = 25°C
PDM
D = PW / T
PW
T
10 μ
100 μ
1 m
10 m
100 m
1
10
100
Pulse Width PW (s)


Normalized Transient Thermal Impedance vs. Pulse Width (Diode)
Normalized Transient Thermal Impedance γs (t)
10
1
0.1
0.01
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1 shot pulse
θj – c(t) = γs (t) • θj – c
θj – c = 2.35°C/W
Tc = 25°C
PDM
D = PW / T
PW
T
10 μ
100 μ
1 m
10 m
100 m
1
10
100
Pulse Width PW (s)

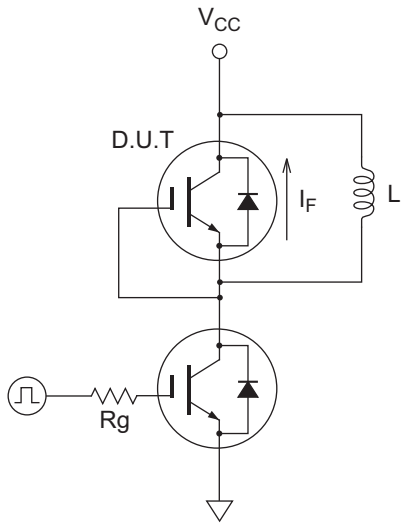
Switching Time Test Circuit



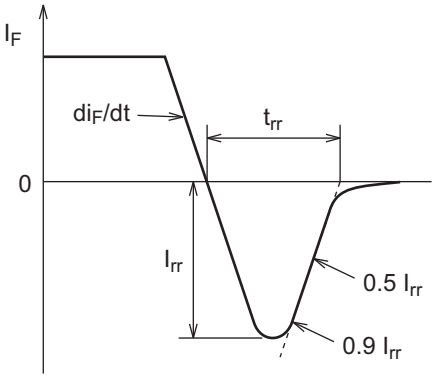
Waveform



Diode Reverse Recovery Time Test Circuit



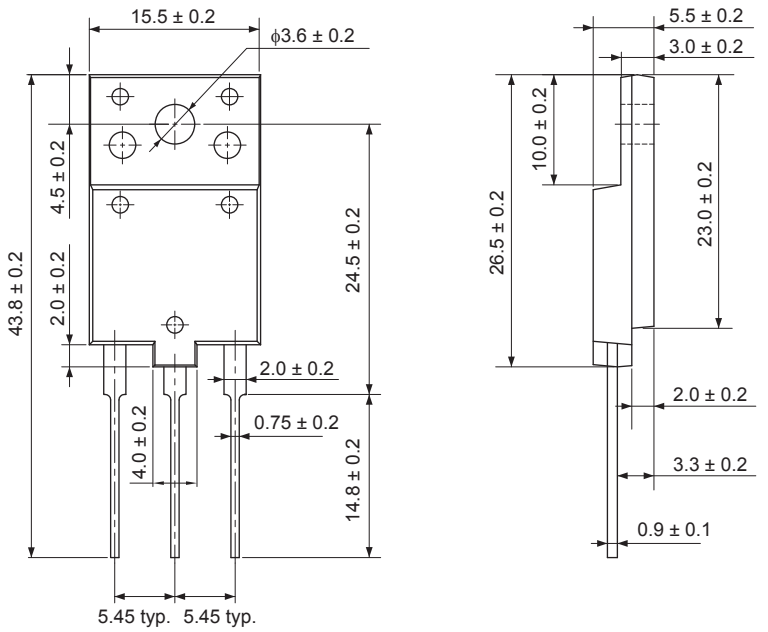
Waveform



Package Dimensions

Package Name	JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
TO-3PFP	—	PRSS0003ZP-A	TO-3PFP	5.5g

Unit: mm



Ordering Information

Orderable Part No.	Quantity	Shipping Container
RJH65T04BDPM-A0#T2	1000pcs	Box(tube)

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