

# RJH60M6DPQ-E0

600V - 40A - IGBT  
Application: Inverter

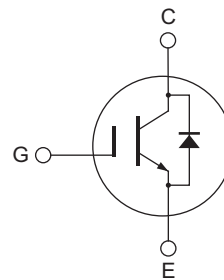
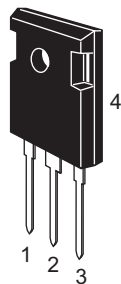
R07DS1088EJ0100  
Rev.1.00  
Jun 27, 2013

## Features

- Short circuit withstand time (8  $\mu$ s typ.)
- Low collector to emitter saturation voltage  
 $V_{CE(sat)} = 1.8$  V typ. (at  $I_C = 40$  A,  $V_{GE} = 15$  V,  $T_a = 25^\circ\text{C}$ )
- Built in fast recovery diode (100 ns typ.) in one package
- Trench gate and thin wafer technology
- High speed switching  
 $t_f = 50$  ns typ. (at  $V_{CC} = 300$  V,  $V_{GE} = 15$  V,  $I_C = 40$  A,  $R_g = 5 \Omega$ ,  $T_a = 25^\circ\text{C}$ , inductive load)

## Outline

RENESAS Package code: PRSS0003ZE-A  
(Package name: TO-247)



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

## Absolute Maximum Ratings

( $T_a = 25^\circ\text{C}$ )

Item	Symbol	Ratings	Unit	
Collector to emitter voltage / diode reverse voltage	$V_{CES} / V_R$	600	V	
Gate to emitter voltage	$V_{GES}$	$\pm 30$	V	
Collector current	$T_C = 25^\circ\text{C}$	$I_C$	80	A
	$T_C = 100^\circ\text{C}$	$I_C$	40	A
Collector peak current	$I_{C(peak)}$ <sup>Note1</sup>	120	A	
Collector to emitter diode forward current	$I_{DF}$	50	A	
Collector to emitter diode forward peak current	$I_{DF(peak)}$ <sup>Note1</sup>	200	A	
Collector dissipation	$P_C$ <sup>Note2</sup>	298	W	
Junction to case thermal resistance (IGBT)	$\theta_{j-c}$ <sup>Note2</sup>	0.42	$^\circ\text{C} / \text{W}$	
Junction to case thermal resistance (Diode)	$\theta_{j-cd}$ <sup>Note2</sup>	1.07	$^\circ\text{C} / \text{W}$	
Junction temperature	$T_j$	150	$^\circ\text{C}$	
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$	

Notes: 1.  $PW \leq 10 \mu\text{s}$ , duty cycle  $\leq 1\%$

2. Value at  $T_C = 25^\circ\text{C}$

## Electrical Characteristics

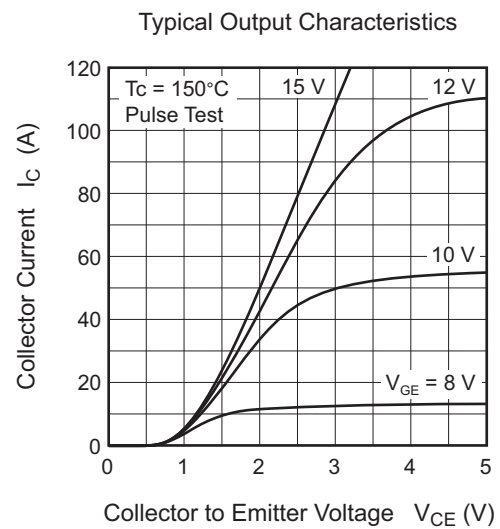
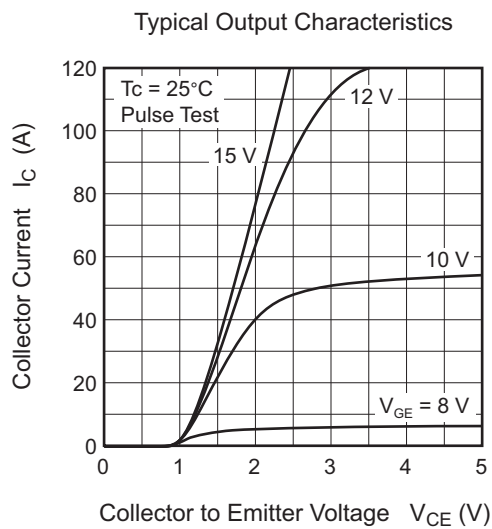
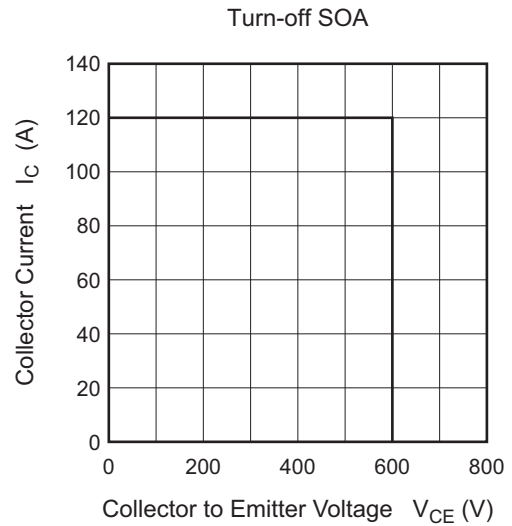
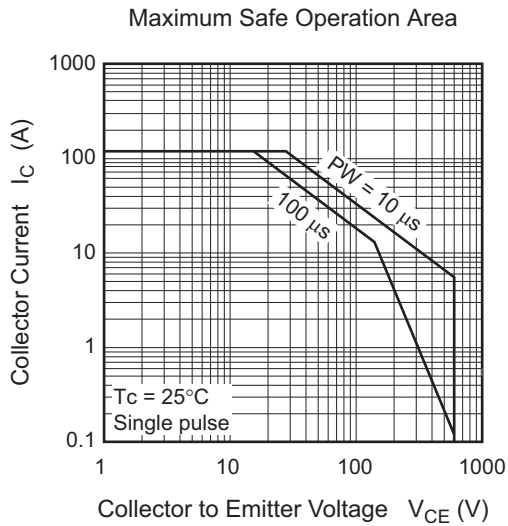
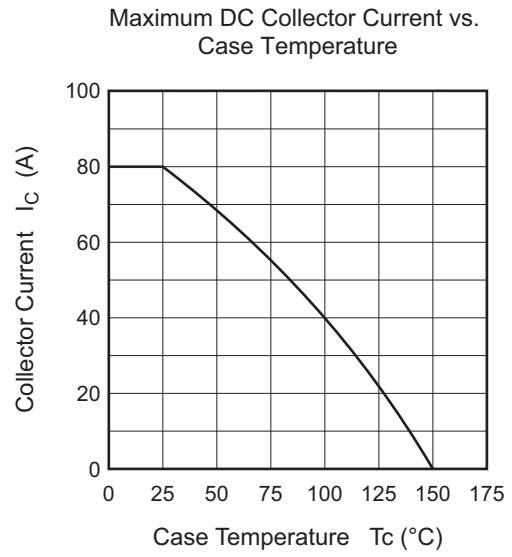
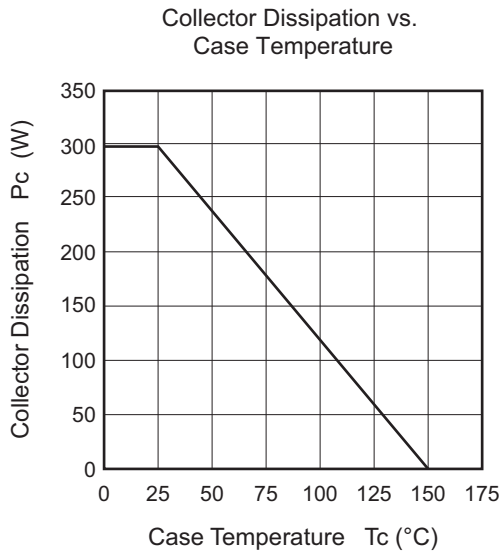
(Ta = 25°C)

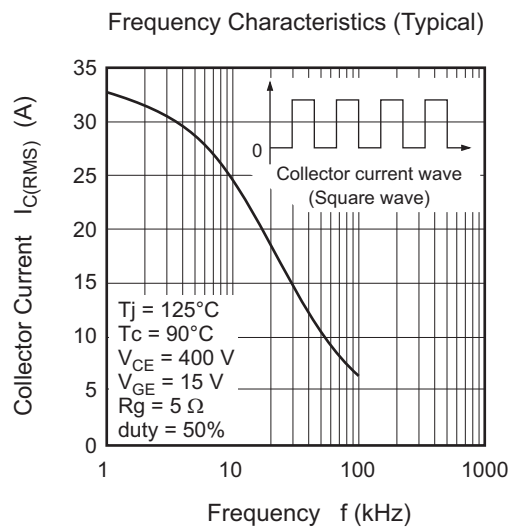
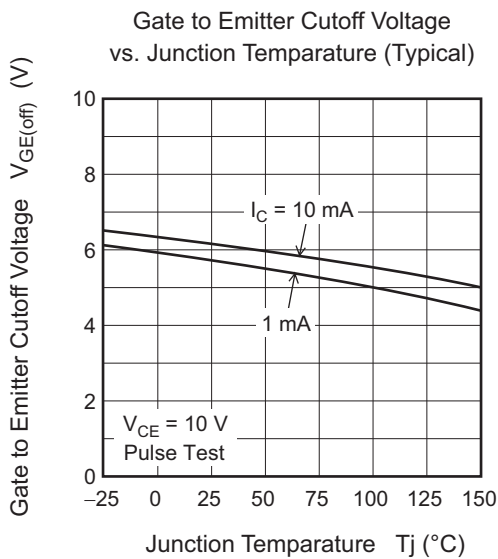
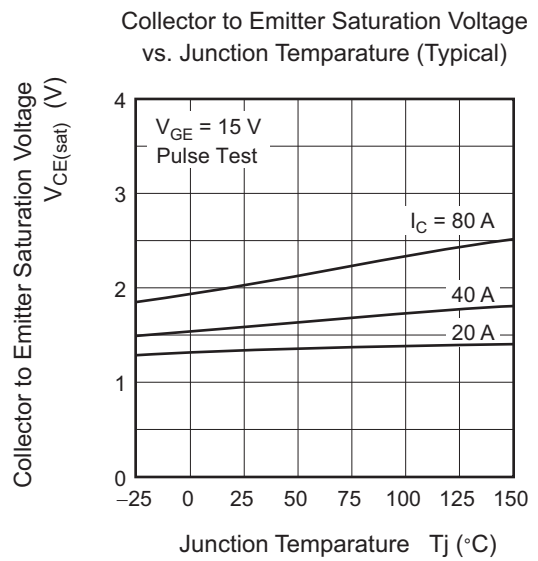
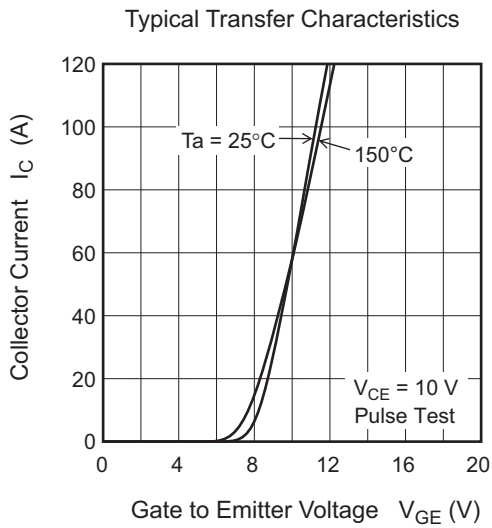
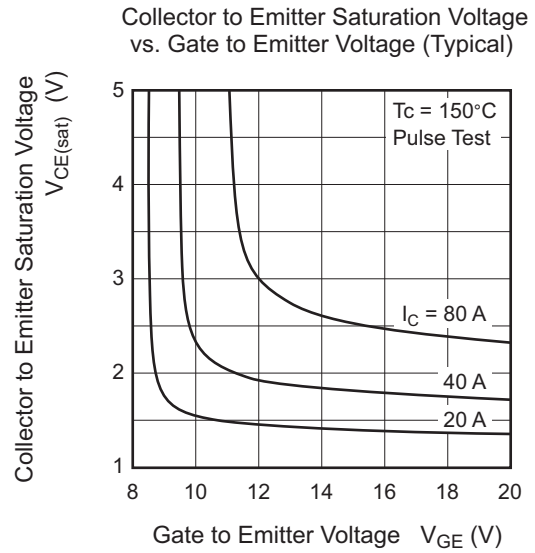
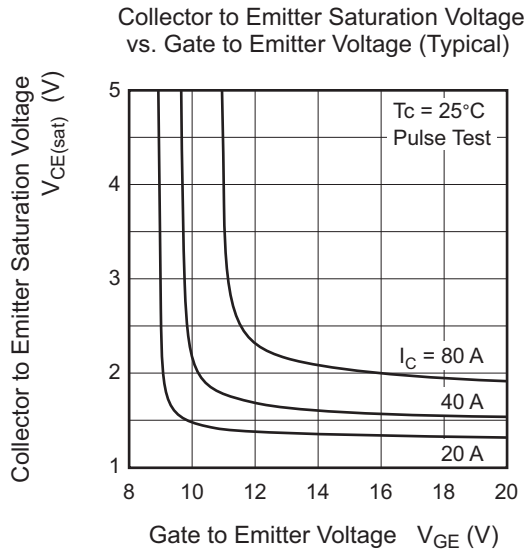
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero gate voltage collector current / Diode reverse current	$I_{CES} / I_R$	—	—	5	$\mu\text{A}$	$V_{CE} = 600 \text{ V}, V_{GE} = 0$
Gate to emitter leak current	$I_{GES}$	—	—	$\pm 1$	$\mu\text{A}$	$V_{GE} = \pm 30 \text{ V}, V_{CE} = 0$
Gate to emitter cutoff voltage	$V_{GE(off)}$	5	—	7	V	$V_{CE} = 10 \text{ V}, I_C = 1 \text{ mA}$
Collector to emitter saturation voltage	$V_{CE(sat)}$	—	1.8	2.3	V	$I_C = 40 \text{ A}, V_{GE} = 15 \text{ V}$ <sup>Note3</sup>
	$V_{CE(sat)}$	—	2.2	—	V	$I_C = 80 \text{ A}, V_{GE} = 15 \text{ V}$ <sup>Note3</sup>
Input capacitance	$C_{ies}$	—	2500	—	pF	$V_{CE} = 25 \text{ V}$
Output capacitance	$C_{oes}$	—	175	—	pF	$V_{GE} = 0$
Reverse transfer capacitance	$C_{res}$	—	100	—	pF	$f = 1 \text{ MHz}$
Total gate charge	$Q_g$	—	170	—	nC	$V_{GE} = 15 \text{ V}$
Gate to emitter charge	$Q_{ge}$	—	20	—	nC	$V_{CE} = 300 \text{ V}$
Gate to collector charge	$Q_{gc}$	—	90	—	nC	$I_C = 40 \text{ A}$
Turn-on delay time	$t_{d(on)}$	—	55	—	ns	$V_{CC} = 300 \text{ V}$
Rise time	$t_r$	—	50	—	ns	$V_{GE} = 15 \text{ V}$
Turn-off delay time	$t_{d(off)}$	—	215	—	ns	$I_C = 40 \text{ A}$
Fall time	$t_f$	—	50	—	ns	$R_g = 5 \Omega$
Turn-on energy	$E_{on}$	—	1.11	—	mJ	Inductive load
Turn-off energy	$E_{off}$	—	0.99	—	mJ	
Total switching energy	$E_{total}$	—	2.10	—	mJ	
Short circuit withstand time	$t_{sc}$	6	8	—	$\mu\text{s}$	$T_C = 100 \text{ }^\circ\text{C}$ $V_{CC} \leq 360 \text{ V}, V_{GE} = 15 \text{ V}$

FRD Forward voltage	$V_F$	—	1.3	1.8	V	$I_F = 40 \text{ A}$ <sup>Note3</sup>
FRD reverse recovery time	$t_{rr}$	—	100	—	ns	$I_F = 40 \text{ A}$ $di_F/dt = 100 \text{ A}/\mu\text{s}$
FRD reverse recovery charge	$Q_{rr}$	—	0.22	—	$\mu\text{C}$	
FRD peak reverse recovery current	$I_{rr}$	—	5.0	—	A	

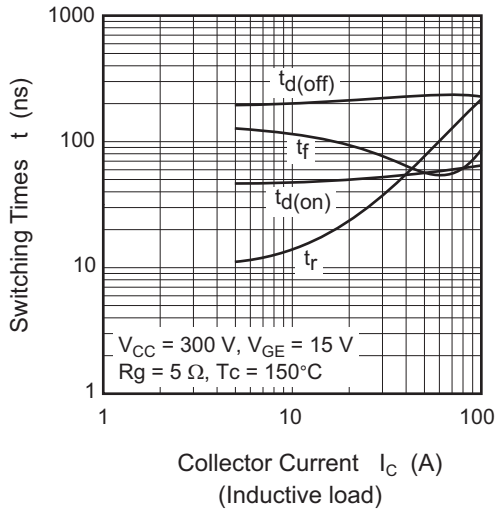
Notes: 3. Pulse test.

Main Characteristics

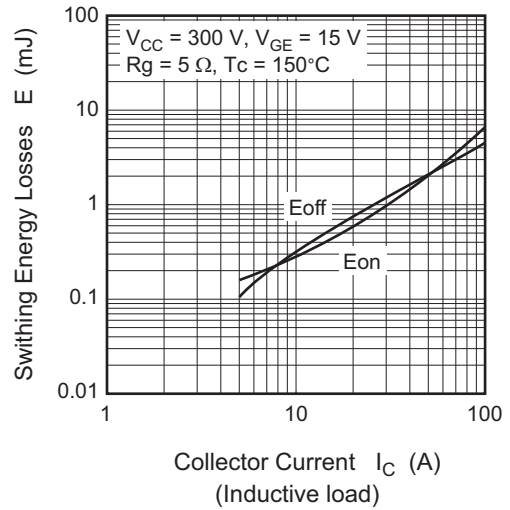




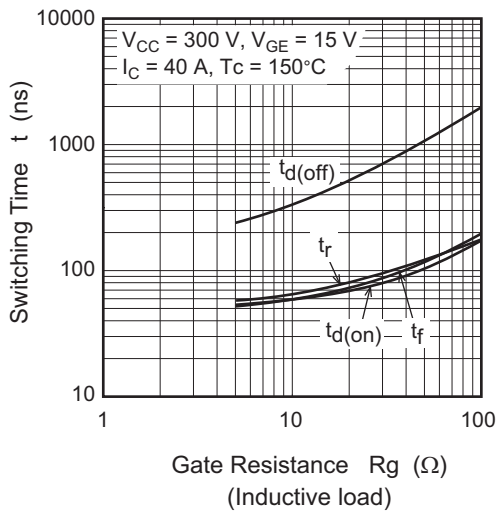
Switching Characteristics (Typical) (1)



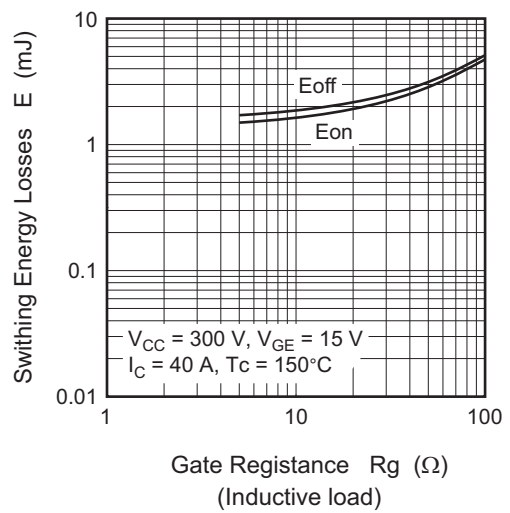
Switching Characteristics (Typical) (2)



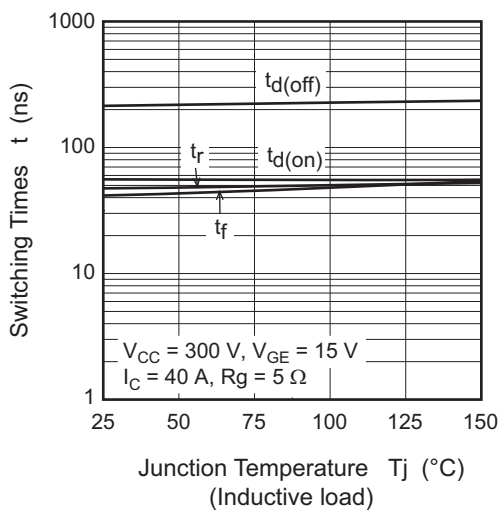
Switching Characteristics (Typical) (3)



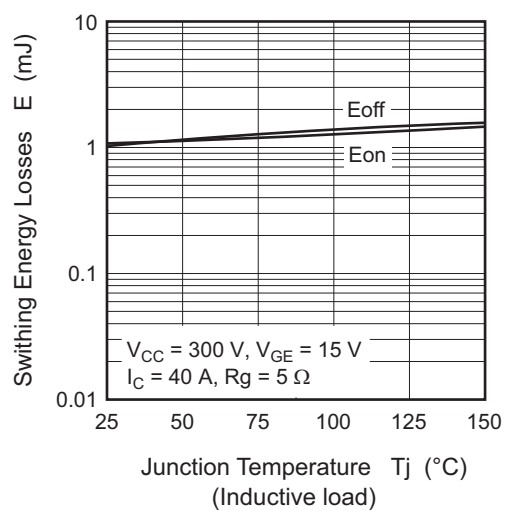
Switching Characteristics (Typical) (4)



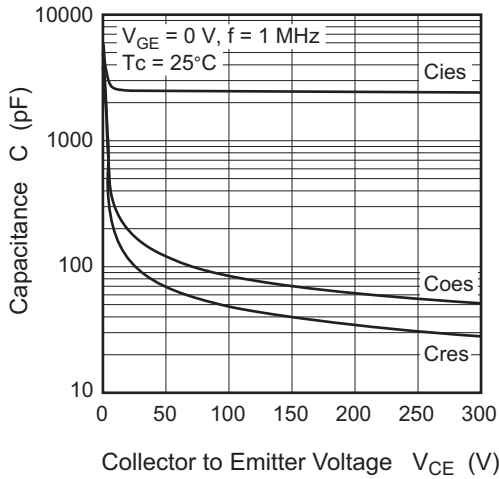
Switching Characteristics (Typical) (5)



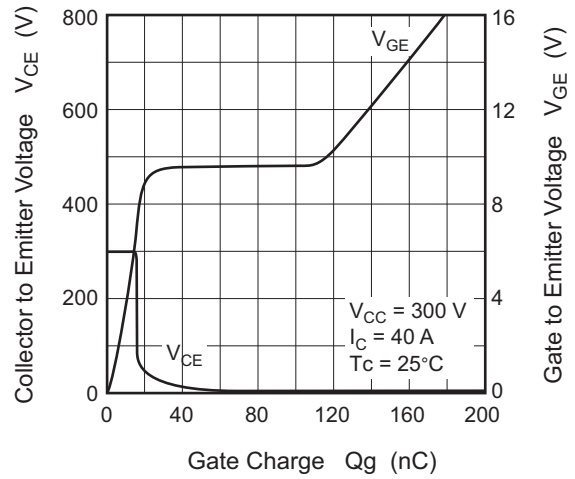
Switching Characteristics (Typical) (6)



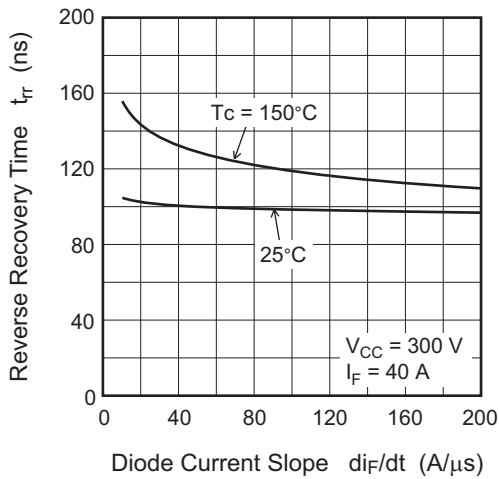
Typical Capacitance vs. Collector to Emitter Voltage



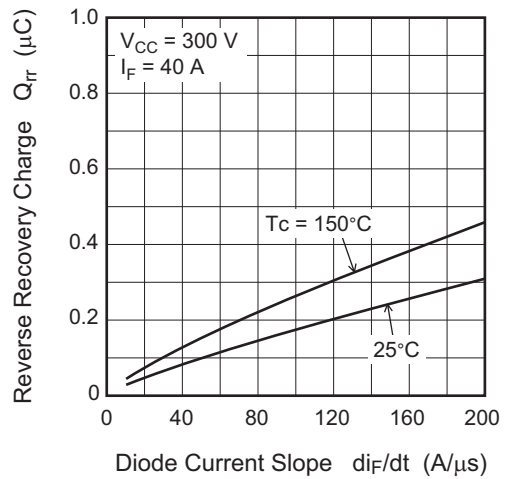
Dynamic Input Characteristics (Typical)



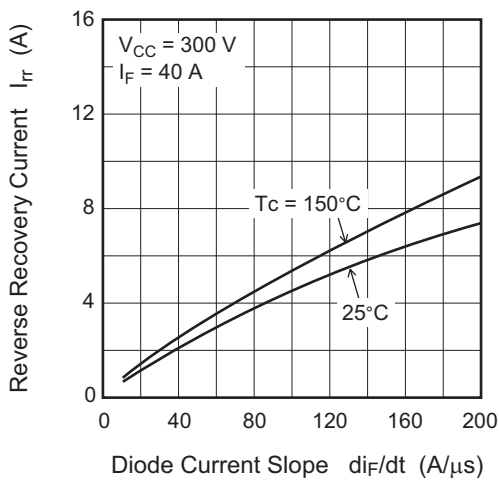
Reverse Recovery Time vs. Diode Current Slope (Typical)



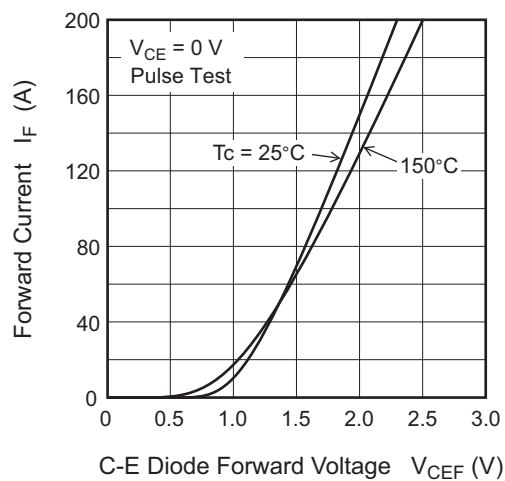
Reverse Recovery Charge vs. Diode Current Slope (Typical)

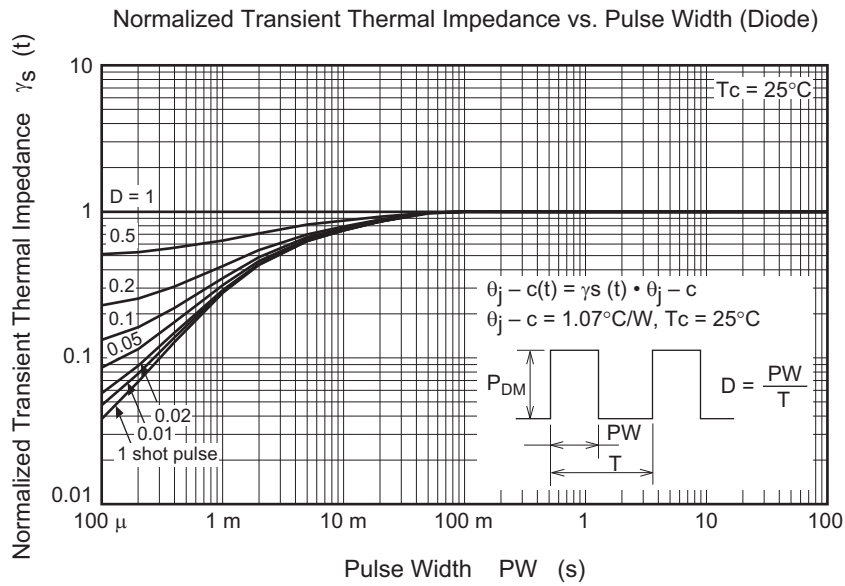
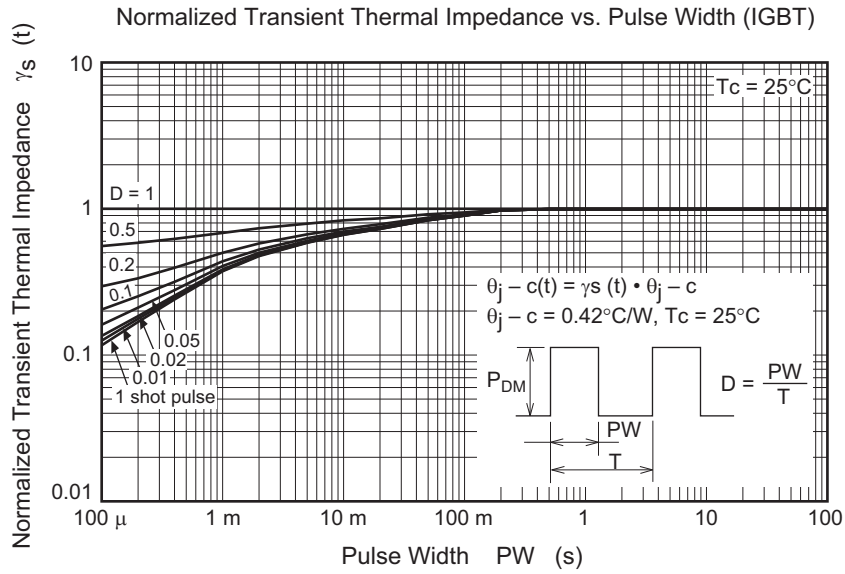


Reverse Recovery Current vs. Diode Current Slope (Typical)

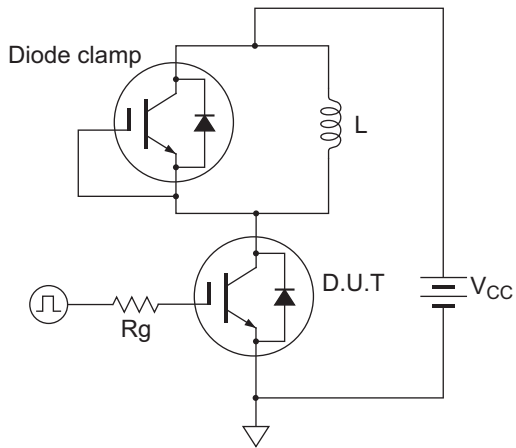


Forward Current vs. Forward Voltage (Typical)

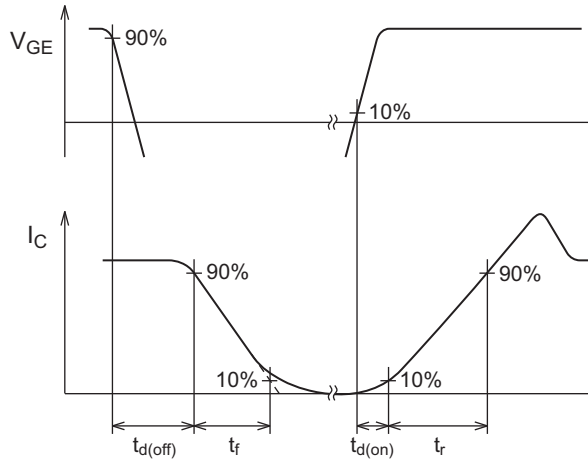




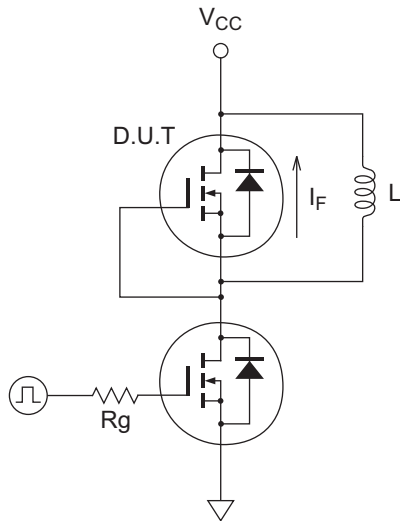
Switching Time Test Circuit



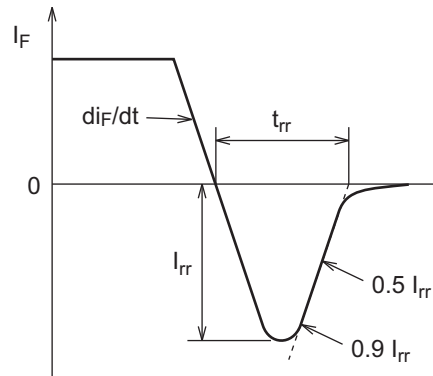
Waveform



Diode Reverse Recovery Time Test Circuit

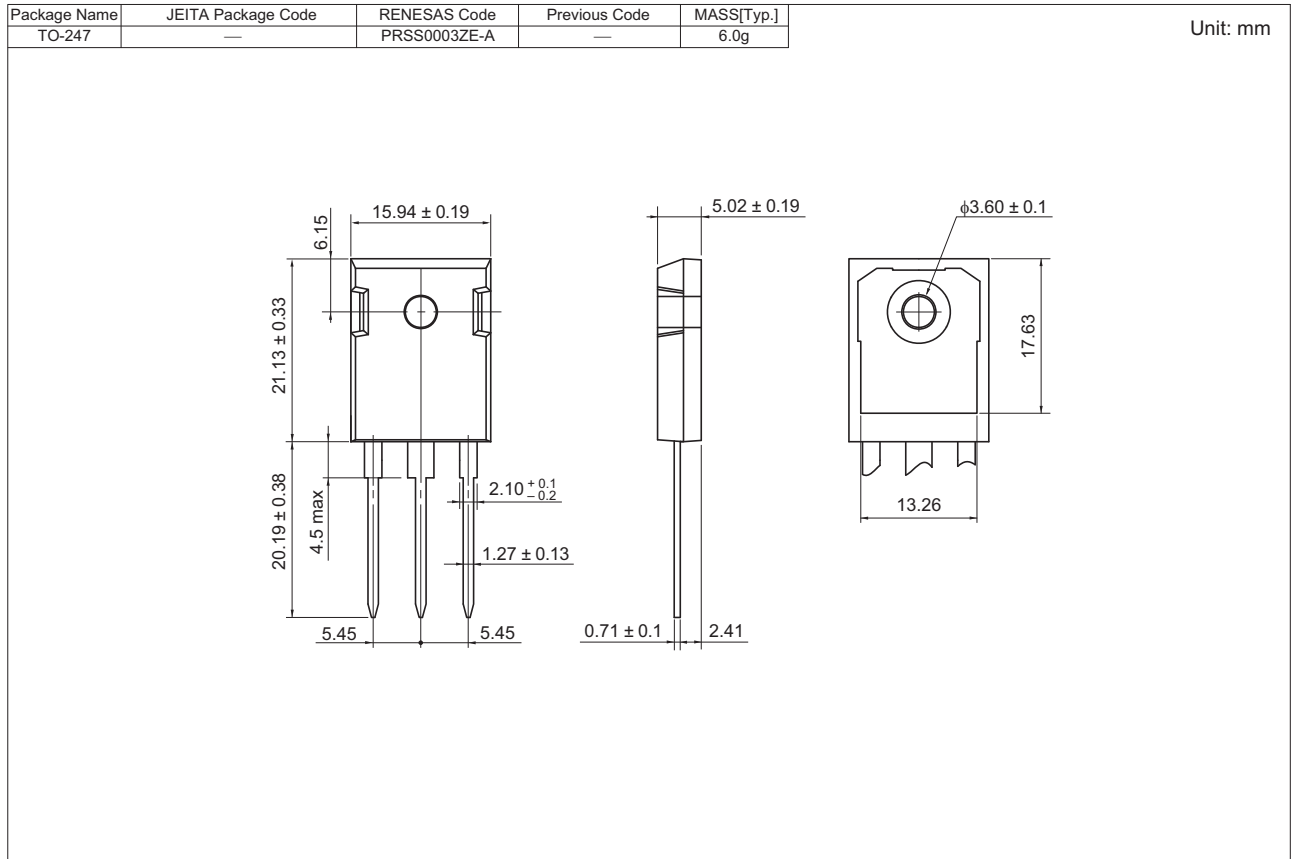


Waveform





### Package Dimension



### Ordering Information

Orderable Part Number	Quantity	Shipping Container
RJH60M6DPQ-E0#T2	450 pcs	Tube

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