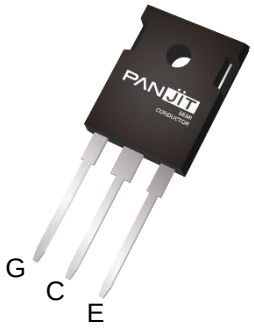
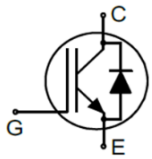
PTGH4065S1

High speed 650V Field Stop Trench IGBT co-packed with fast and soft recovery anti-parallel diode

V_{CE}	650 V	I_C	40 A
V_{CEsat}	1.65 V	E_{OFF}	0.39 mJ

TO-247-3L





Features

- Superior high speed switching IGBT
- Low saturation voltage 1.65V at T_{VJ} 25 °C
- Co-packed with low Qrr and soft recovery diode
- Maximum junction temperature T_{VJ} 175 °C
- Easy paralleling usage due to positive coefficient V_{CEsat}
- Lead free in compliance with EU RoHS 2.0
- Green molding compound as per IEC 61249 standard

Mechanical Data

- Case: TO-247-3L molded plastic
- Terminals: Solderable per MIL-STD-750, Method 2026
- Approx. Weight: 6.157grams

Application

- UPS
- PV Inverter
- EV Charger
- Welding machine
- Home appliance

Maximum Ratings

PARAMETER	SYMBOL	LIMIT	UNITS
Collector-Emitter Voltage	V_{CE}	650	V
Gate-Emitter Voltage	V_{GE}	± 20	V
DC Collector Current @ T_C = 25°C	I_C	76	A
DC Collector Current @ T_C = 100°C		46	
Pulsed Collector Current, t_P limited by T_{VJmax}	I_{Cpulse}	120	A
Turn-off safe operating area V_{CC} ≤ 400 V, V_{CE},peak < 650 V, V_{GE} = 0/15 V, R_{Goff} ≥ 10 Ω, T_{VJ} ≤ 175 °C	-	120	A
Diode Forward Current @ T_C = 25°C	I_F	40	A
Diode Forward Current @ T_C = 100°C		20	

PARAMETER	SYMBOL	LIMIT	UNITS
Pulsed Diode Current, t_P limited by T_{VJmax}	I_{Fpulse}	120	A
Power Dissipation @ T_C = 25°C Power Dissipation @ T_C = 100°C	P_{total}	220 110	W
Operating Junction Temperature Range	T_{VJ}	-40 to +175	°C
Storage Temperature Range	T_{STG}	-55 to +150	°C
Soldering Temperature,1/8" from case for 5 seconds	T_{SLD}	260	°C

Typical Ratings

PARAMETER	SYMBOL	TYP.	UNITS
Non−Repetitive Forward Surge Current (Half−Sine Pulse, tp = 8.3 ms, T_C = 25°C) (Half−Sine Pulse, tp = 8.3 ms, T_C = 150°C)	I_{FM}	 350 295	A
Internal emitter inductance measured 5mm(0.197 in.) from case	L_E	13	nH

Thermal Resistance

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS
Thermal Resistance Junction to Case, for IGBT	$R_{\theta JC}$	-	-	-	0.68	°C/W
Thermal Resistance Junction to Case, for Diode	$R_{\theta JC}$	-	-	-	0.68	°C/W
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	-	-	-	40	°C/W

Electrical Characteristics (T_{VJ} = 25 °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
Static Characteristic						
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	V_{GE} = 0V, I_C = 0.5mA	650	-	-	V
Collector-Emitter Saturation Voltage	V_{CEsat}	V_{GE} = 15V, I_C = 40A T_{VJ} = 25 °C T_{VJ} = 125 °C T_{VJ} = 175 °C	 - - -	 1.65 1.85 2.00	 2.25 - -	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	I_C = 40mA, V_{CE} = V_{GE}	3.0	4.5	6.0	V
Collector-Emitter Cut Off Current	I_{CES}	V_{GE} = 0V, V_{CE} = 650V	-	-	80	μA
Gate-Emitter Leakage Current	I_{GES}	V_{GE} = 20V, V_{CE} = 0V	-	-	200	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 40A	-	29	-	S
Dynamic Characteristic						
Input Capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V f = 1MHz	-	1840	-	pF
Output Capacitance	C_{oes}		-	95	-	
Reverse Transfer Capacitance	C_{res}		-	13	-	
Gate Charge	Q_G	V_{CE} = 520V, I_C = 40A V_{GE} = 15V	-	65	-	nC
Switching Characteristic, Inductive Load						
Turn-On Delay Time	$t_{d(on)}$	T_{VJ} = 25 °C V_{CC} = 400V, I_C = 20A V_{GE} = 0 / 15V R_G = 10Ω	-	14	-	ns
Rise Time	t_r		-	14	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	96	-	ns
Fall Time	t_f		-	16	-	ns
Turn-On Energy	E_{on}		-	0.33	-	mJ
Turn-Off Energy	E_{off}		-	0.12	-	mJ
Total Switching Energy	E_{ts}		-	0.45	-	mJ
Turn-On Delay Time	$t_{d(on)}$	T_{VJ} = 25 °C V_{CC} = 400V, I_C = 40A V_{GE} = 0 / 15V R_G = 10Ω	-	15	-	ns
Rise Time	t_r		-	31	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	86	-	ns
Fall Time	t_f		-	38	-	ns
Turn-On Energy	E_{on}		-	0.75	-	mJ
Turn-Off Energy	E_{off}		-	0.39	-	mJ
Total Switching Energy	E_{ts}		-	1.14	-	mJ

Turn-On Delay Time	$t_{d(on)}$	T_{VJ} = 175°C V_{CC} = 400V, I_C = 20A V_{GE} = 0 / 15V R_G = 10Ω	-	13	-	ns
Rise Time	t_r		-	14	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	123	-	ns
Fall Time	t_f		-	17	-	ns
Turn-On Energy	E_{on}		-	0.59	-	mJ
Turn-Off Energy	E_{off}		-	0.22	-	mJ
Total Switching Energy	E_{ts}		-	0.81	-	mJ
Turn-On Delay Time	$t_{d(on)}$	T_{VJ} = 175°C V_{CC} = 400V, I_C = 40A V_{GE} = 0 / 15V R_G = 10Ω	-	15	-	ns
Rise Time	t_r		-	31	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	103	-	ns
Fall Time	t_f		-	33	-	ns
Turn-On Energy	E_{on}		-	1.21	-	mJ
Turn-Off Energy	E_{off}		-	0.49	-	mJ
Total Switching Energy	E_{ts}		-	1.70	-	mJ

Diode Characteristic

Diode Froward Voltage	V_F	V_{GE} = 0V, I_F = 20A T_{VJ} = 25 °C T_{VJ} = 125 °C T_{VJ} = 175 °C	- - -	1.60 1.30 1.20	- - -	V
Reverse Recovery Time	t_{rr}	I_F = 20 A, V_R = 400 V, di/dt = 1000 A/μs, T_{VJ} = 25 °C	-	64	-	ns
Reverse Recovery Charge	Q_{rr}		-	400	-	nC
Reverse Recovery Current	I_{rrm}		-	13	-	A
Reverse Recovery Energy	E_{rec}		-	56	-	μJ
Diode peak rate of fall of reverse recovery current	dirr/dt		-	597	-	A/μs
Reverse Recovery Time	t_{rr}	I_F = 20 A, V_R = 400 V, di/dt = 1000 A/μs, T_{VJ} = 175 °C	-	80	-	ns
Reverse Recovery Charge	Q_{rr}		-	746	-	nC
Reverse Recovery Current	I_{rrm}		-	18	-	A
Reverse Recovery Energy	E_{rec}		-	122	-	μJ
Diode peak rate of fall of reverse recovery current	dirr/dt		-	465	-	A/μs

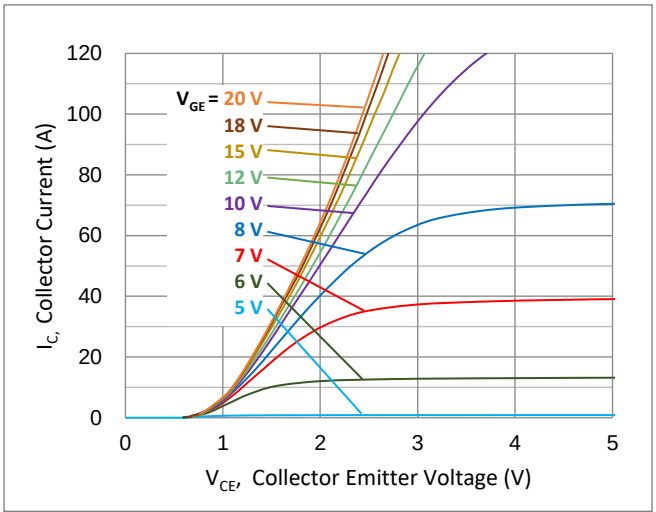


Fig.1 Typical Output Characteristic (T_{VJ} = 25ºC)

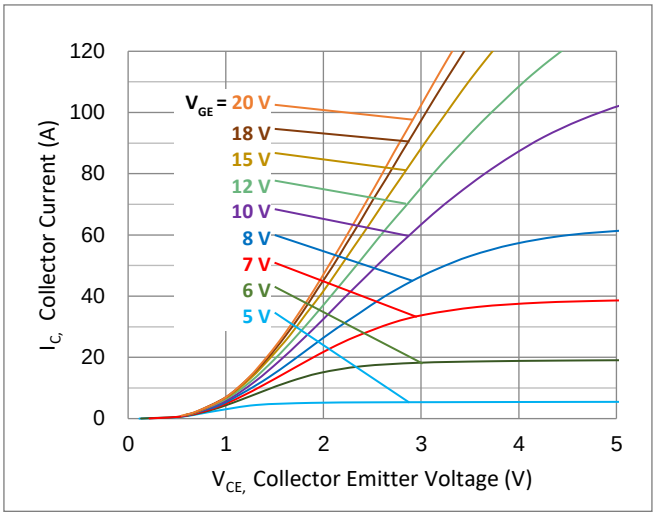


Fig.2 Typical Output Characteristic (T_{VJ} = 175ºC)

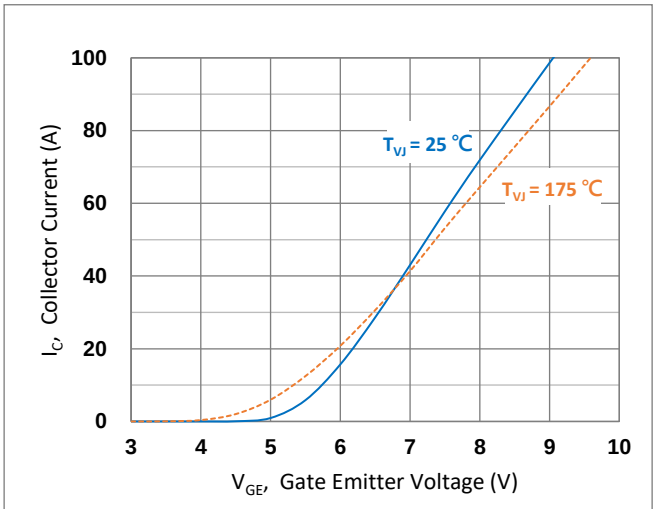


Fig.3 Typical Transfer Characteristic (V_{CE} = 20V)

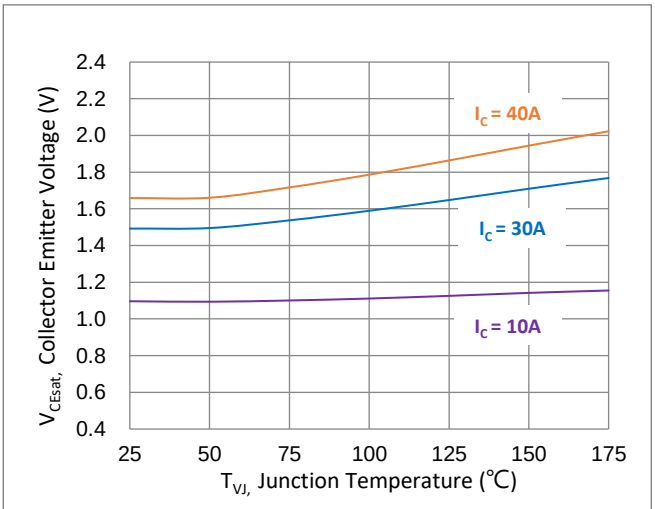


Fig.4 V_{CEsat} vs. T_{VJ}

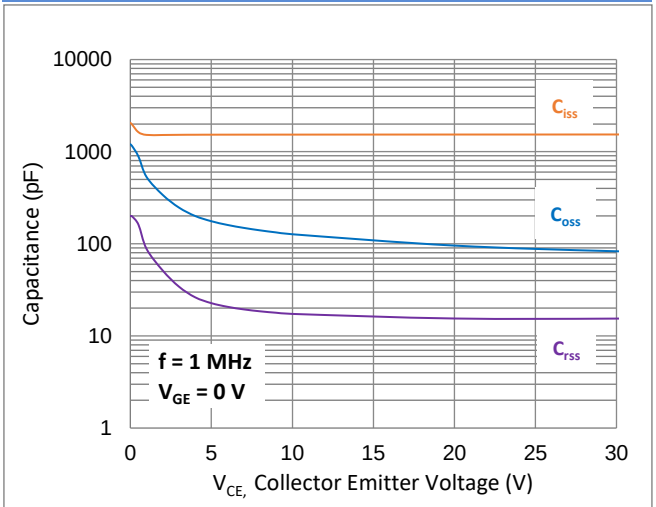


Fig.5 Typical Capacitance

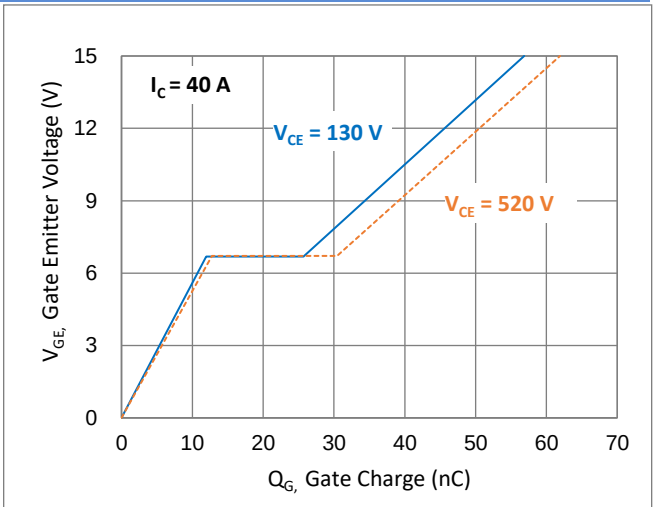


Fig.6 Typical Gate Charge

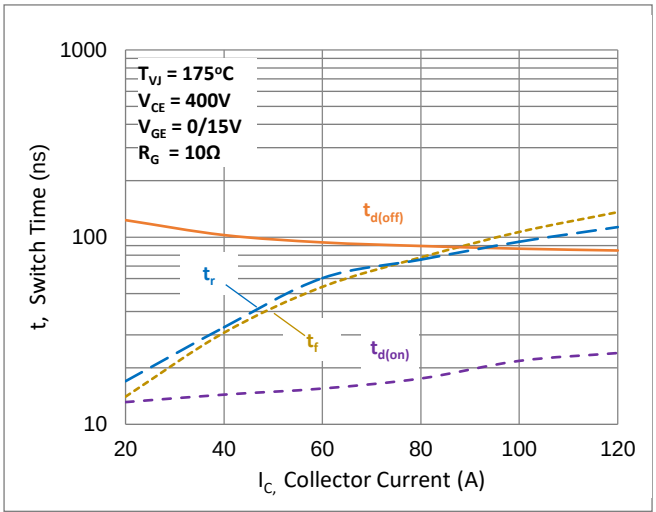


Fig.7 Typical Switching Time vs. I_C

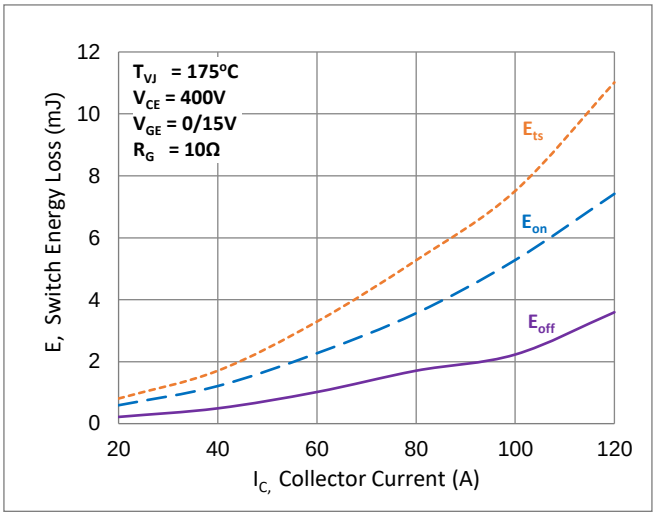


Fig.8 Typical Switching Energy Loss vs. I_C

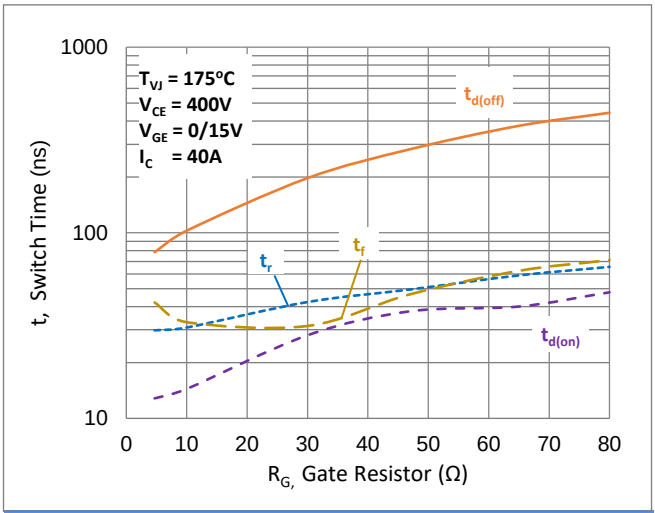


Fig.9 Typical Switching Time vs. R_G

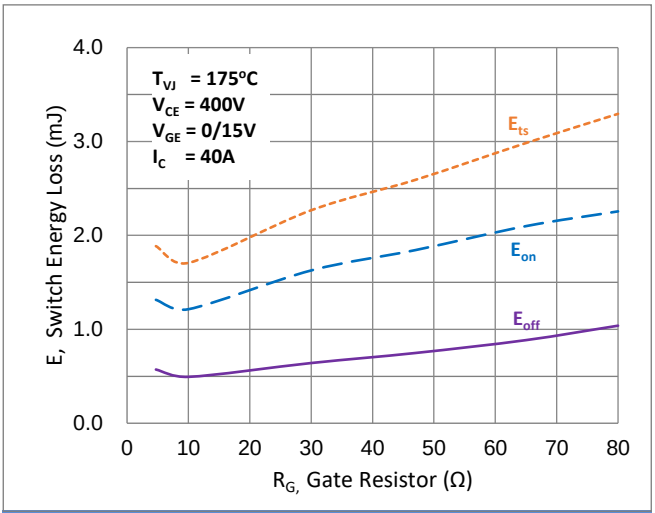


Fig.10 Typical Switching Energy Loss vs. R_G

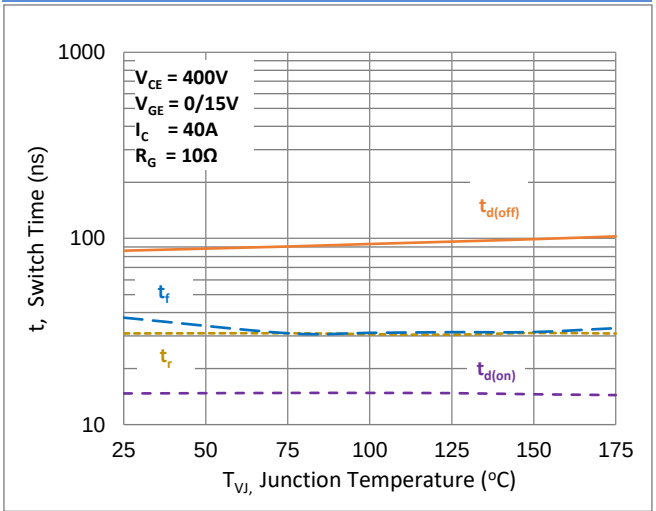


Fig.11 Typical Switching Time vs. T_{VJ}

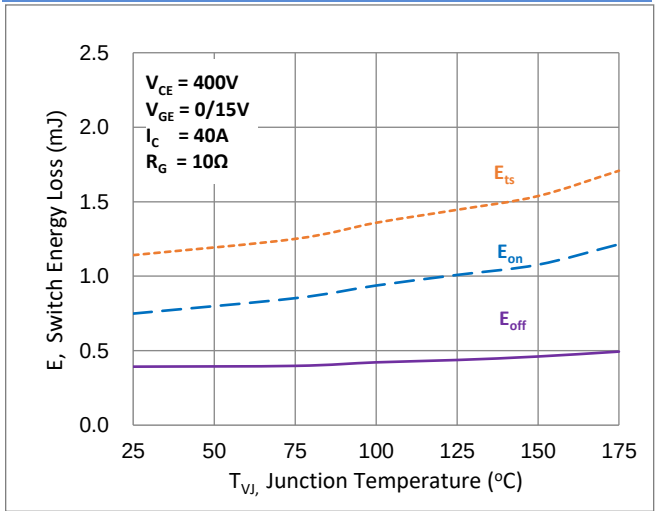


Fig.12 Typical Switching Energy Loss vs. T_{VJ}

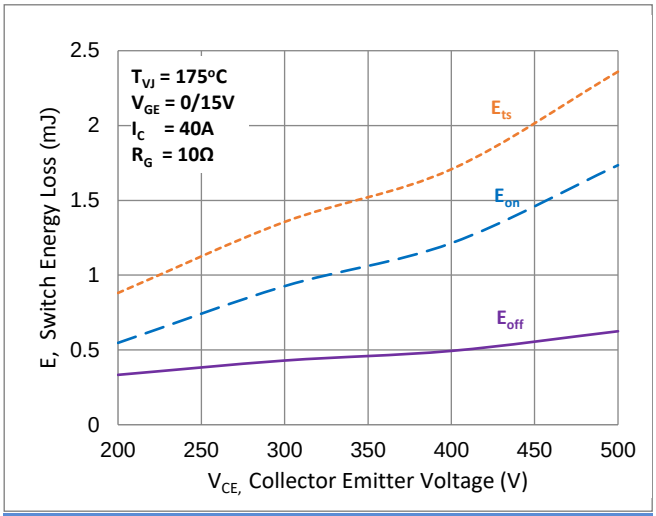


Fig.13 Typical Switching Energy Loss vs. V_{CE}

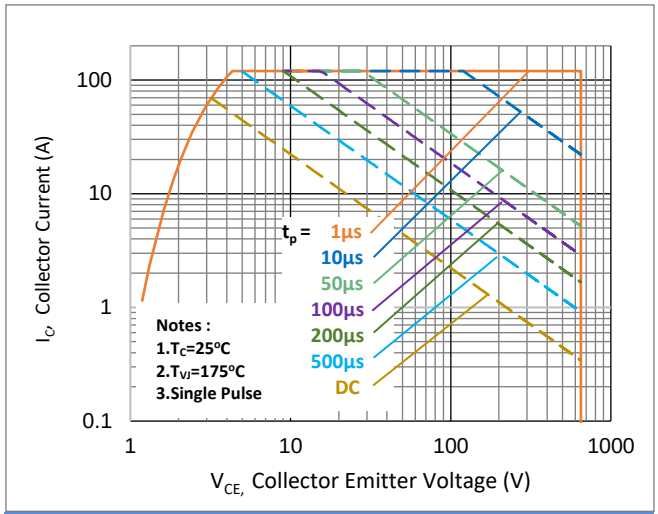


Fig.14 SOA Characteristic

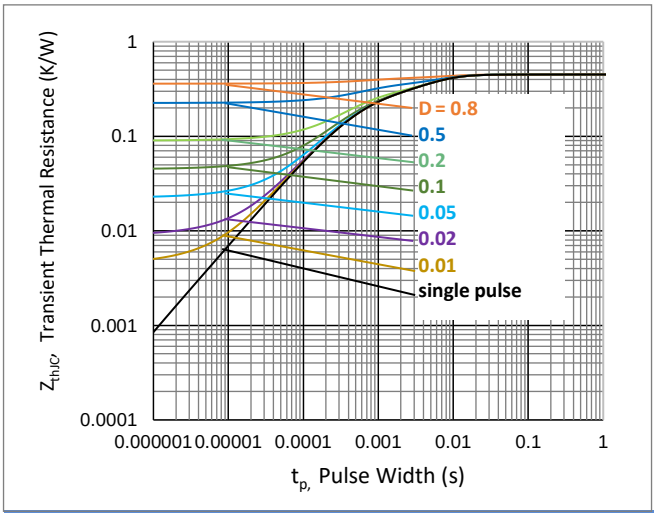


Fig.15 IGBT Thermal Impedance

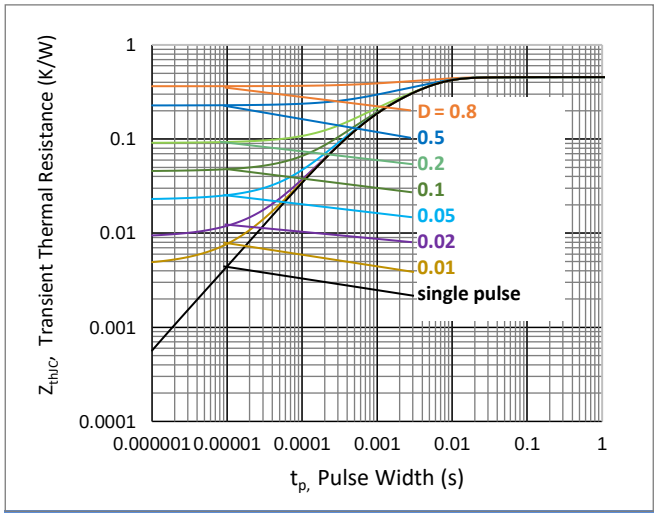


Fig.16 Diode Thermal Impedance

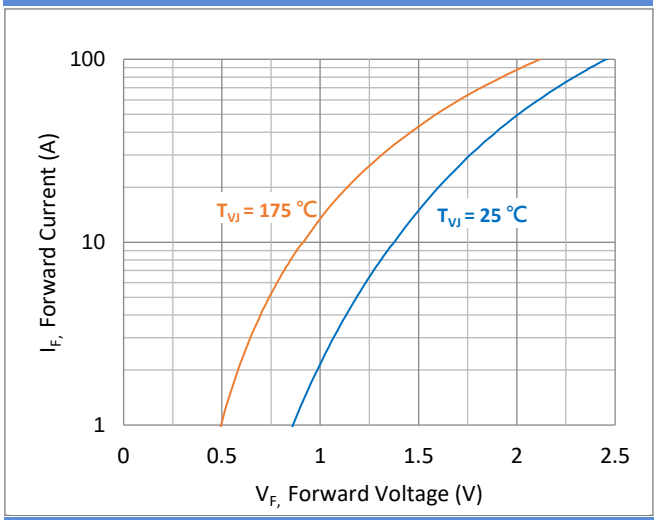


Fig.17 Typical Diode Forward Characteristic

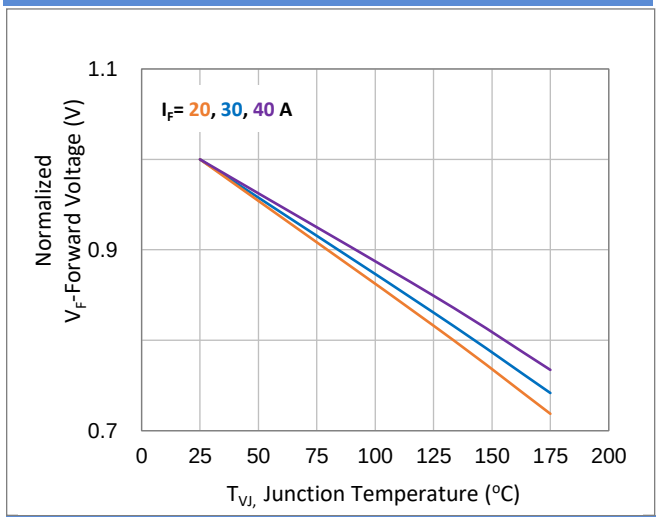


Fig.18 Diode Forward Voltage vs. T_{VJ}

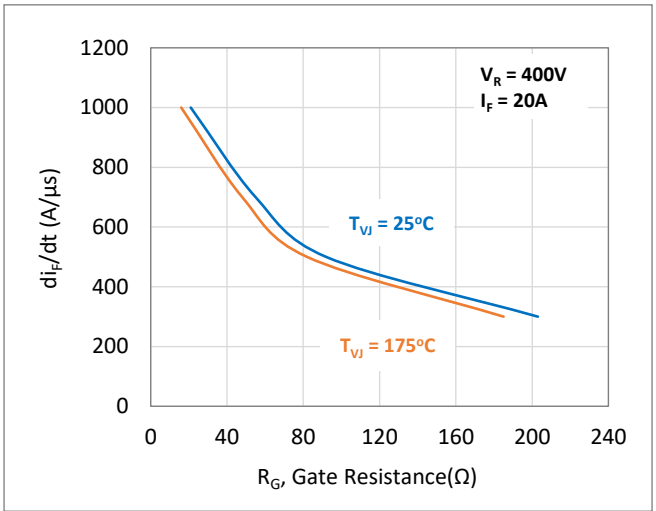


Fig.19 Typical Diode Current Slope vs. R_G

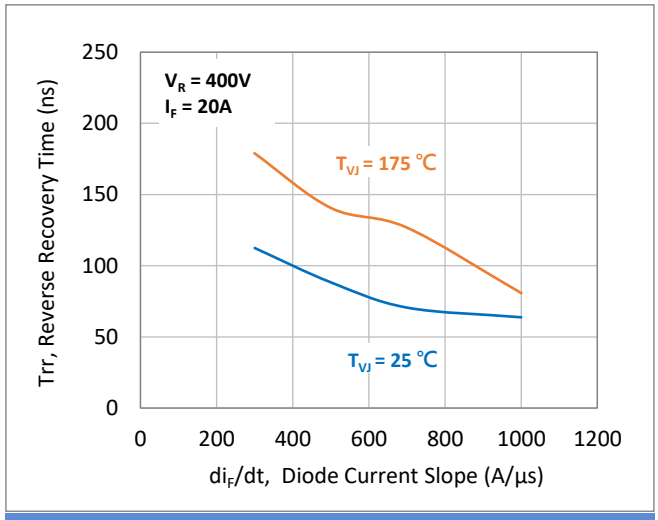


Fig.20 Typical Reverse Recovery Time vs di_F/dt

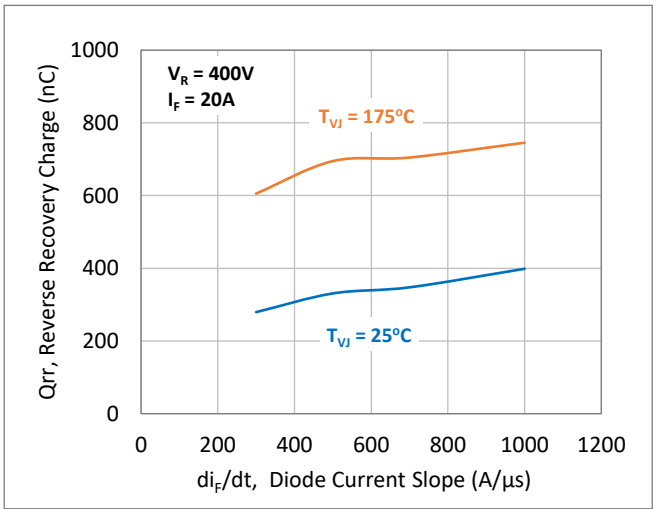


Fig.21 Typical Reverse Recovery Charge vs di_F/dt

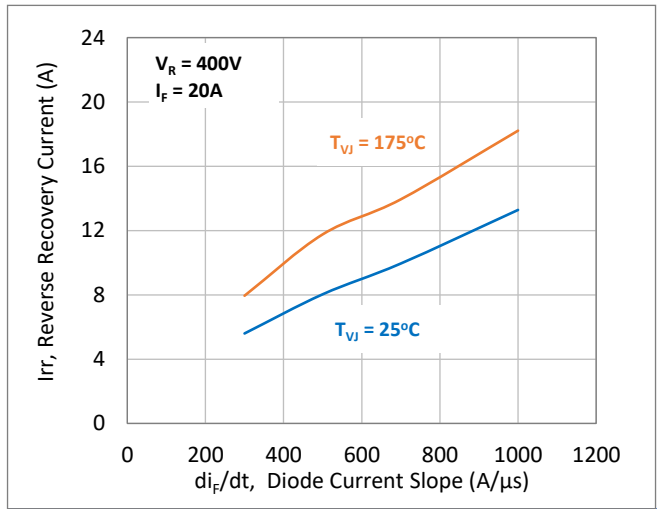


Fig.22 Typical Reverse Recovery Current vs di_F/dt

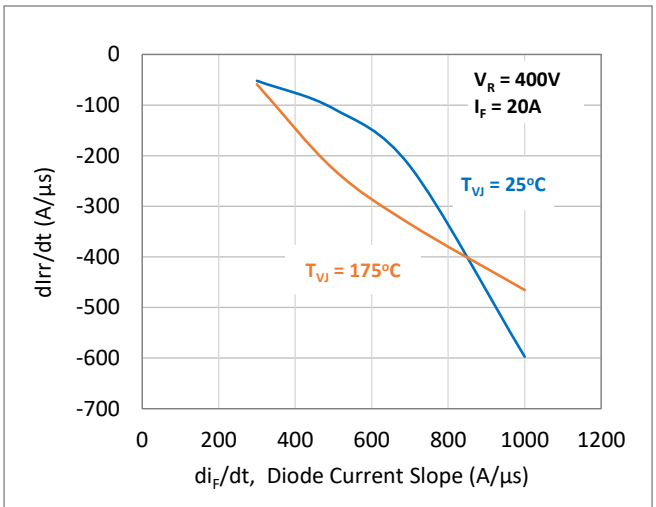


Fig.23 dIrr/dt vs. di_F/dt

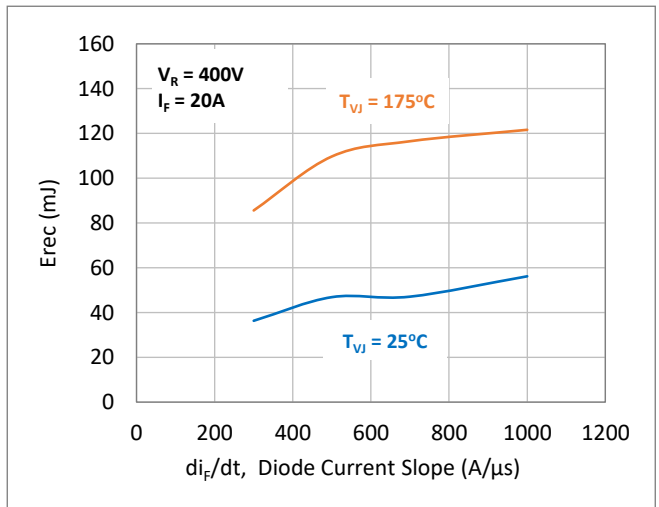


Fig.24 Typical reverse energy losses vs. di_F/dt

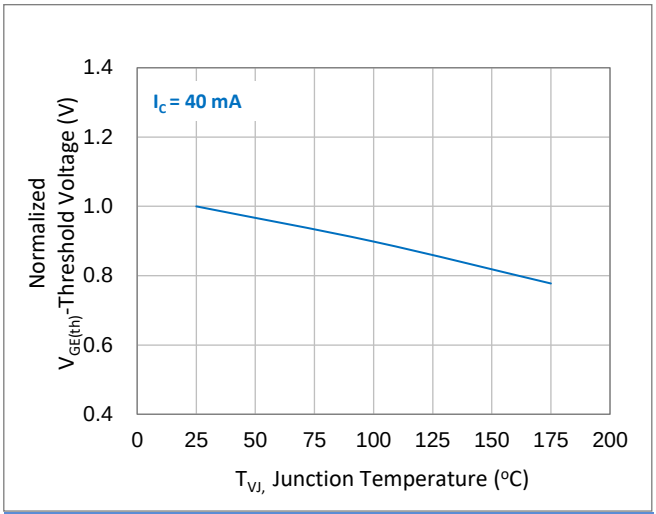


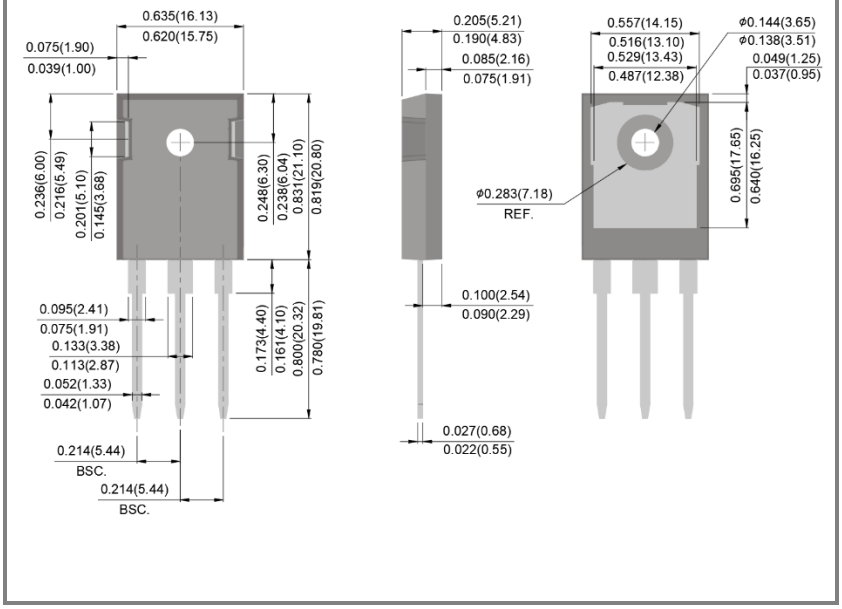
Fig.25 Gate-Emitter Threshold Voltage vs. T_{VJ}

Product and Packing Information

Part No.	Package Type	Packing Type	Marking
PTGH4065S1	TO-247-3L	30pcs / Tube	TGH4065S1

Packaging Information

TO-247-3L Dimension — Unit: inch(mm)



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