

PTDH40120BY

1200V 40A Si IGBT Discrete

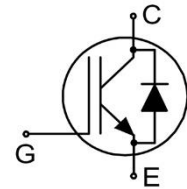
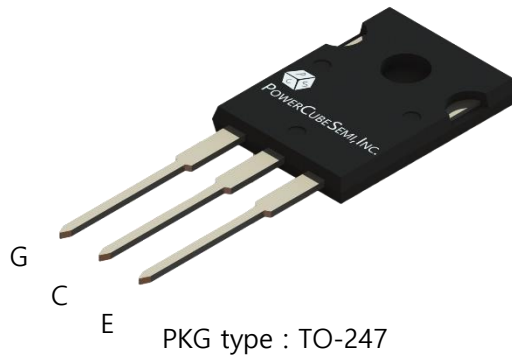
Features

Si IGBT Discrete

- Rated to 1200V at 40Amps @ $T_j = 25^\circ\text{C}$
- $V_{CE(sat)} = 1.70\text{V}$ @ $I_C = 40\text{A}$
- High breakdown voltage to 1200V for improved reliability
- Maximum Junction Temperature 175°C
- Positive temperature coefficient
- Including fast & soft recovery ant-parallel FWD
- High short circuit capability (10us)

Application

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit	
BV_{CES}	Collector-Emitter Breakdown Voltage	1200	V	
I_C	DC Collector Current	$T_C = 25^\circ\text{C}$	80	A
		$T_C = 100^\circ\text{C}$	40	
$I_{C, Pulse}$	Pulsed Collector Current	160	A	
I_F	Diode Forward Current	$T_C = 25^\circ\text{C}$	80	A
		$T_C = 100^\circ\text{C}$	40	
$I_{F, Pulse}$	Diode Pulsed Current	160	A	
V_{GE}	Continuous Gate-Emitter Voltage	± 20	V	
V_{GE}	Transient Gate-Emitter Voltage	± 30		
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$	375	W
t_{SC}	Short circuit withstand time	10	μs	
T_{vj}	Operating Junction Temperature Range	-40 to 175	$^\circ\text{C}$	
T_{stg}	Storage Temperature Range	-55 to 150		



Package Marking and Ordering Information

Device Marking	Device	Package	Packing Method	Tape width	Quantity
PTDH40120BY	PTDH40120	TO-247	TUBE	-	30

Electrical Characteristics

 $T_j=25^\circ\text{C}$ Unless Otherwise Specified

Static Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit	
			Min	Typ	Max		
BV_{CES}	Collector-Emitter Breakdown Voltage	$I_C=250\mu\text{A}$, $V_{GE}=0\text{V}$	1200	-	-	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=40\text{A}$, $V_{GE}=15\text{V}$	$T_j=25^\circ\text{C}$	-	1.70	2.00	V
			$T_j=125^\circ\text{C}$	-	1.95	-	
			$T_j=150^\circ\text{C}$	-	2.05	-	
$V_{GE(TH)}$	Gate-Emitter Threshold Voltage	$V_{CE}=V_{GE}$, $I_C=1.4\text{mA}$	5.2	5.8	6.5	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$	$T_j=25^\circ\text{C}$	-	-	0.25	mA
			$T_j=150^\circ\text{C}$	-	-	4.00	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$	-	-	100	nA	

Dynamic Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit	
			Min	Typ	Max		
Q_G	Total Gate Charge	$V_{CC}=600\text{V}$, $I_C=40\text{A}$, $V_{GE}=15\text{V}$	-	0.26	-	μC	
V_F	Diode Forward Voltage	$I_F=40\text{A}$	$T_j=25^\circ\text{C}$	-	2.00	2.50	V
			$T_j=125^\circ\text{C}$	-	1.80	-	
			$T_j=150^\circ\text{C}$	-	1.70	-	
C_{IES}	Input Capacitance	$V_{CE}=25\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$	-	5.47	-	nF	
C_{RES}	Reverse Transfer Capacitance		-	0.05	-		



Electrical Characteristics

$T_j=25^{\circ}\text{C}$ Unless Otherwise Specified

Switching Characteristics

Symbol	Parameter	Test Condition	Numerical			Unit	
			Min	Typ	Max		
$t_{d(on)}$	Turn-On Delay Time	$V_{GE}=-5\sim 15\text{V}$, $V_{CC}=600\text{V}$, $I_C=40\text{A}$, $R_G=20\Omega$	-	23	-	ns	
t_r	Turn-On Rise Time		-	25	-		
			-	26	-		
$t_{d(off)}$	Turn-Off Delay Time		$T_j=25^{\circ}\text{C}$	-	267	-	
			$T_j=125^{\circ}\text{C}$	-	298	-	
			$T_j=150^{\circ}\text{C}$	-	321	-	
t_f	Turn-Off Fall Time		$T_j=25^{\circ}\text{C}$	-	175	-	
			$T_j=125^{\circ}\text{C}$	-	262	-	
		$T_j=150^{\circ}\text{C}$	-	315	-		
E_{on}	Turn-On Switching Energy	$T_j=25^{\circ}\text{C}$	-	4.2	-	mJ	
		$T_j=125^{\circ}\text{C}$	-	4.3	-		
		$T_j=150^{\circ}\text{C}$	-	4.4	-		
E_{off}	Turn-Off Switching Energy	$T_j=25^{\circ}\text{C}$	-	2.1	-	mJ	
		$T_j=125^{\circ}\text{C}$	-	3.5	-		
		$T_j=150^{\circ}\text{C}$	-	3.9	-		
E_{rec}	Reverse Recovery Energy	$T_j=25^{\circ}\text{C}$	-	1.2	-	mJ	
		$T_j=125^{\circ}\text{C}$	-	2.9	-		
		$T_j=150^{\circ}\text{C}$	-	3.6	-		
I_{rr}	Reverse Recovery Current	$I_F=40\text{A}$, $V_R=600\text{V}$, $di/dt=-520\text{A}/\mu\text{s}$	$T_j=25^{\circ}\text{C}$	-	16	-	A
			$T_j=125^{\circ}\text{C}$	-	19	-	
			$T_j=150^{\circ}\text{C}$	-	23	-	
Q_{rr}	Reverse Recovery Charge		$T_j=25^{\circ}\text{C}$	-	3.23	-	uC
			$T_j=125^{\circ}\text{C}$	-	7.41	-	
			$T_j=150^{\circ}\text{C}$	-	8.95	-	
T_{rr}	Reverse Recovery Time		$T_j=25^{\circ}\text{C}$	-	524	-	ns
			$T_j=125^{\circ}\text{C}$	-	825	-	
		$T_j=150^{\circ}\text{C}$	-	938	-		

Thermal Characteristics

Symbol	Parameter	Numerical	Unit
$R_{\theta(J-A)}$	Thermal Resistance Junction-to-Ambient	40	K/W
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for IGBT	0.40	
$R_{\theta(J-C)}$	Thermal Resistance Junction-to-Case for Diode	0.65	

Typical Characteristics

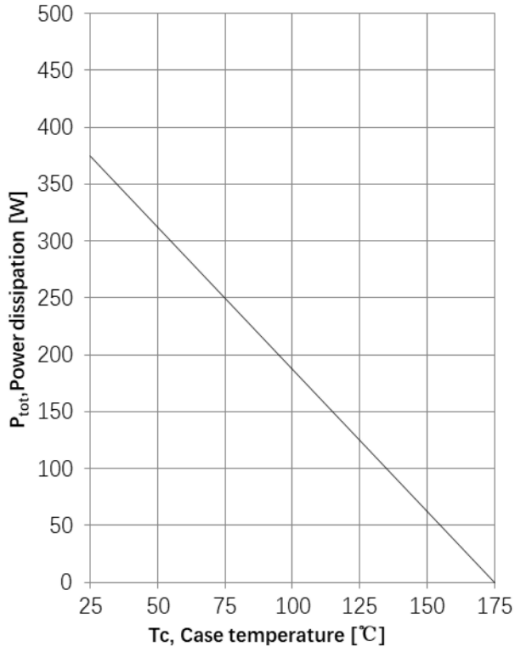


Figure 1. Power dissipation as a function of case temperature ($T_J \leq 175^\circ\text{C}$)

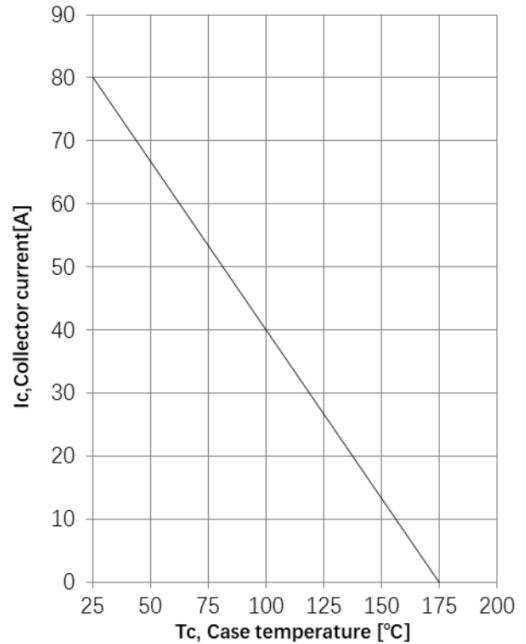


Figure 2. Collector current as a function of case temperature ($V_{GE} \geq 15\text{V}$, $T_J \leq 175^\circ\text{C}$)

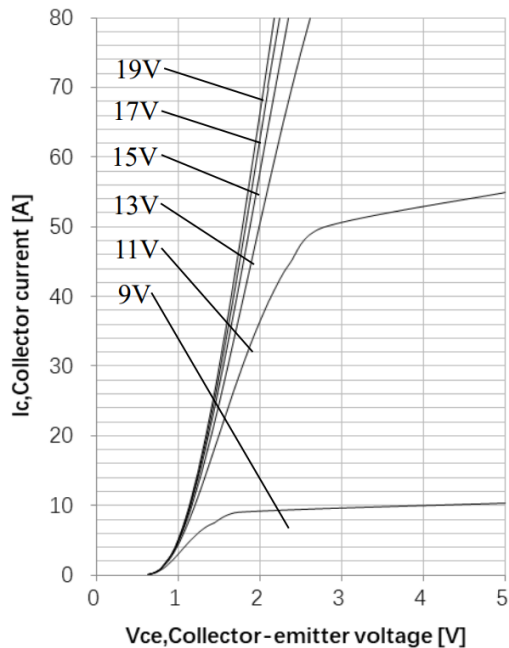


Figure 3. Output Characteristics ($T_J = 25^\circ\text{C}$)

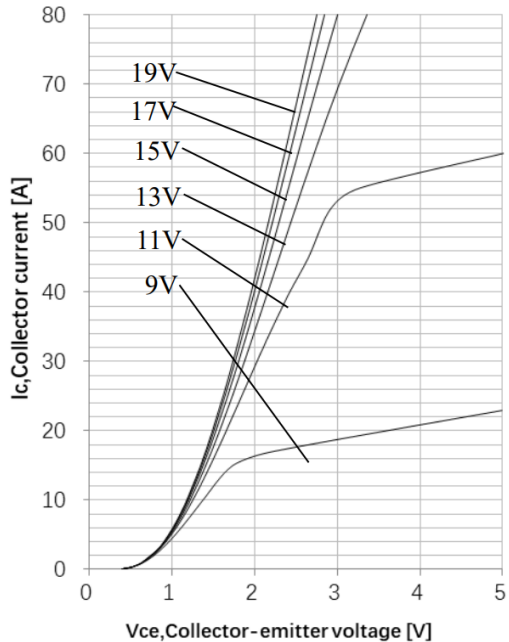


Figure 4. Output Characteristics ($T_J = 150^\circ\text{C}$)

Typical Characteristics

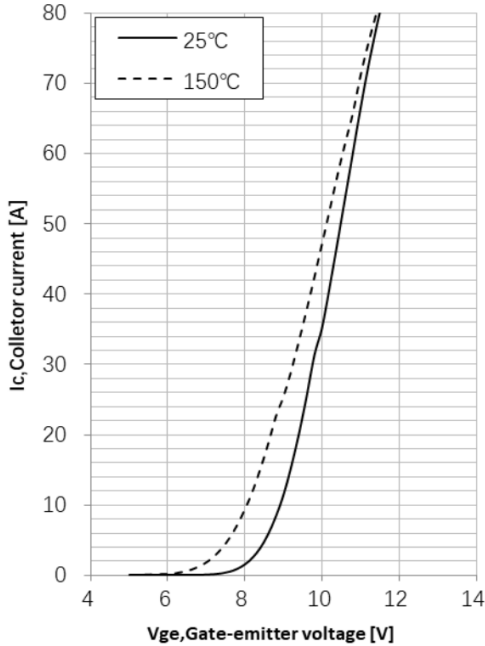


Figure 5. Typical transfer characteristic ($V_{CE}=20V$)

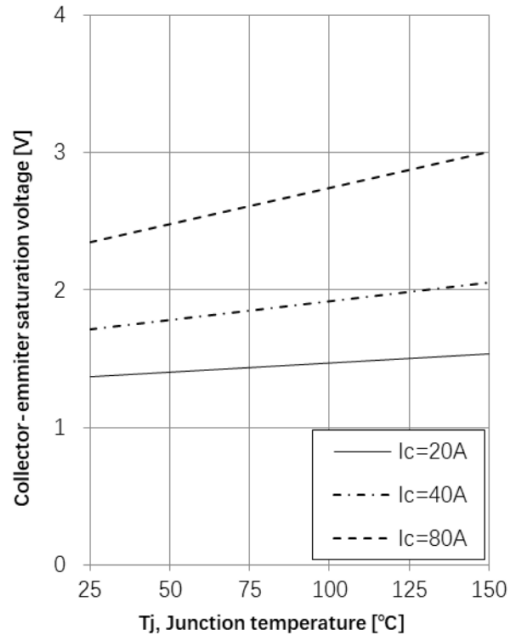


Figure 6. Typical collector-Emitter saturation voltage as a function of junction temperature

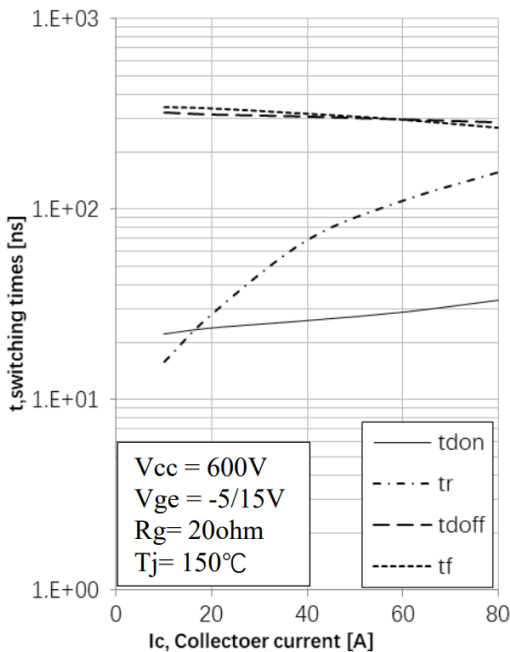


Figure 7. Typical Switching time as a function of collector current

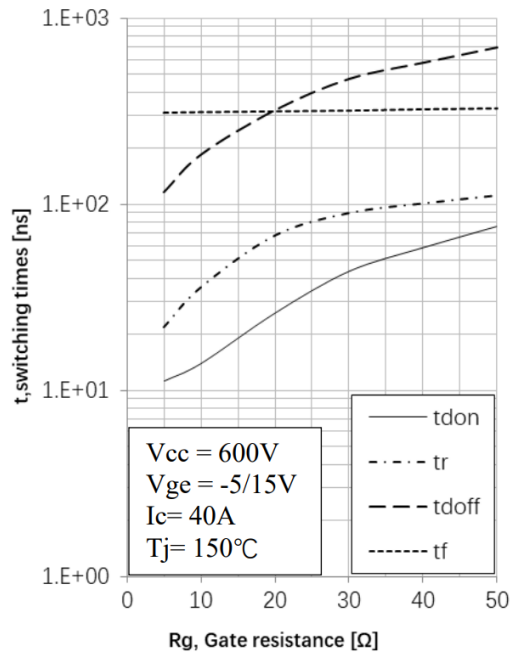


Figure 8. Typical Switching times as a function of gate resistance

Typical Characteristics

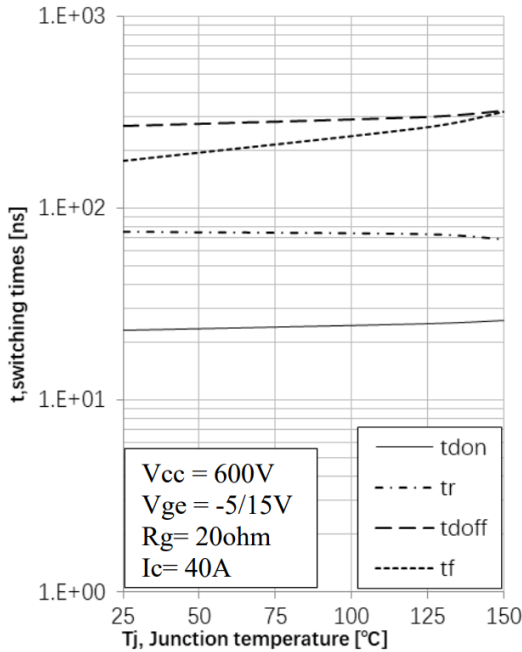


Figure 9. Typical Switching times as a function of junction temperature

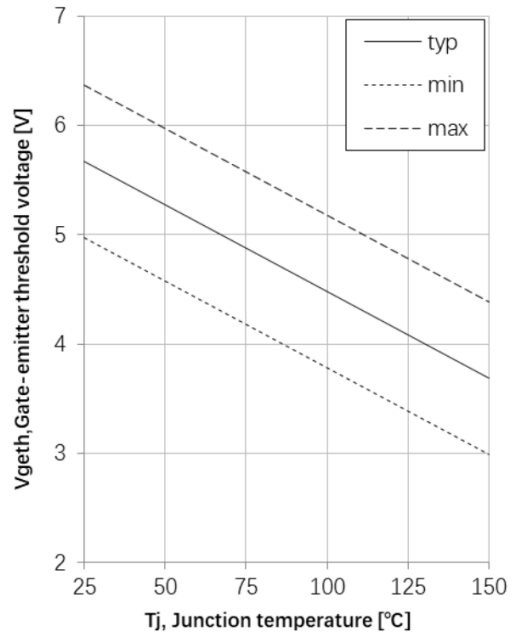


Figure 10. Gate-Emitter threshold voltage as a function of junction temperature

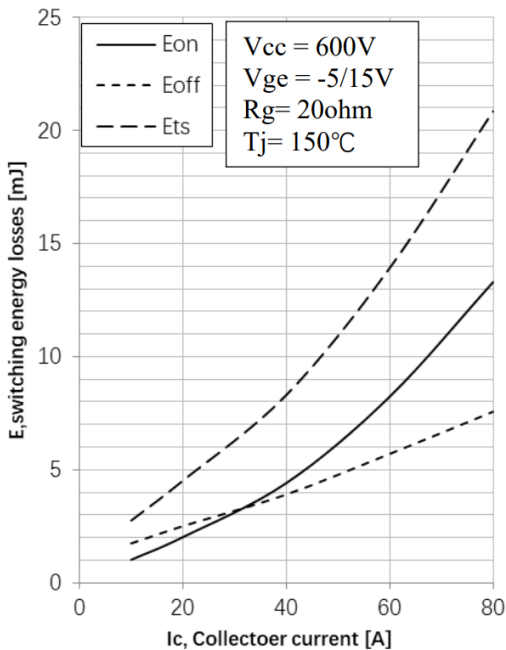


Figure 11. Typical Switching Energy losses as a function of collector current

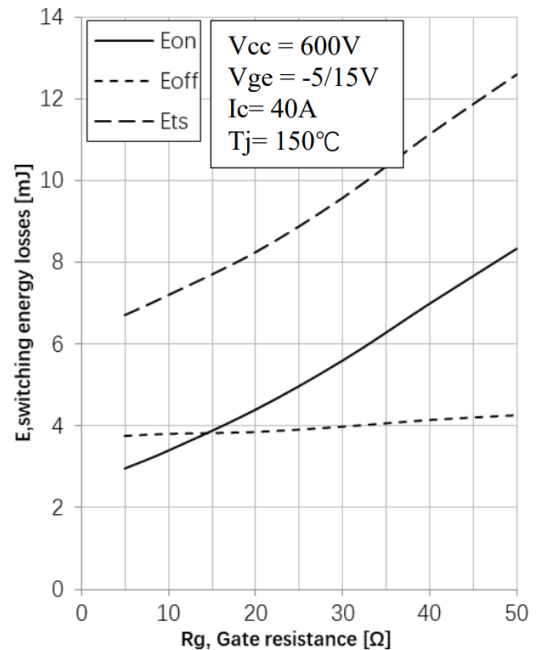


Figure 12. Typical Switching Energy losses as a function of gate resistance

Typical Characteristics

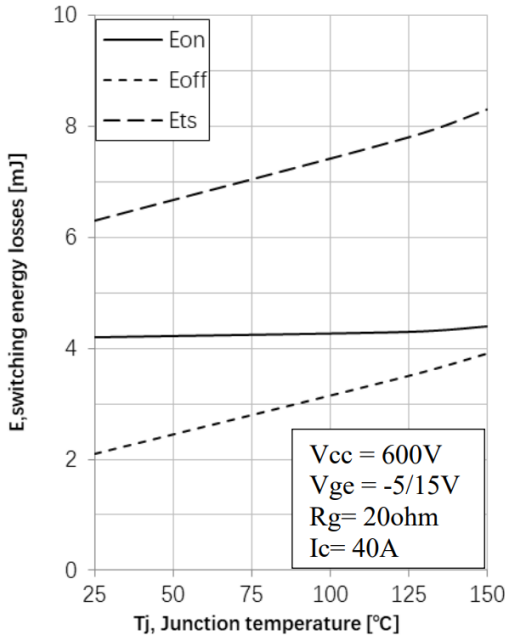


Figure 13. Typical Switching Energy losses as a function of junction temperature

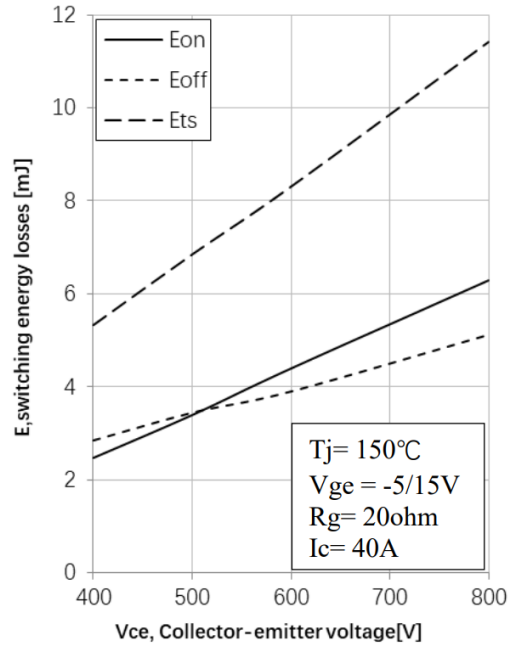


Figure 14. Typical Switching Energy losses as a function of collector-emitter voltage

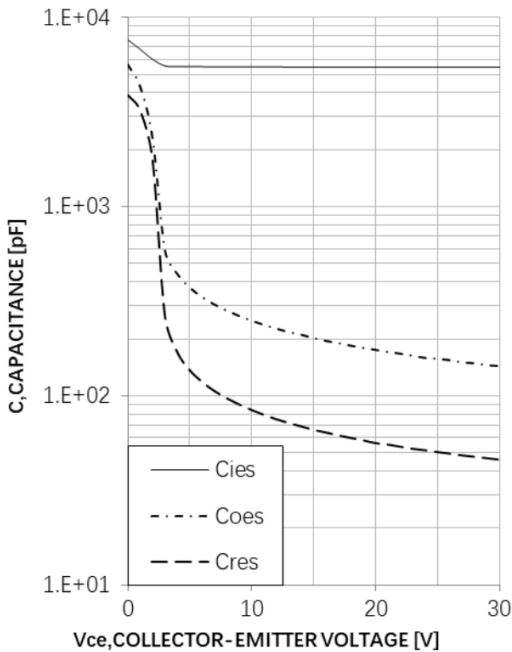


Figure 15. Typical capacitance as a function of collector-emitter voltage

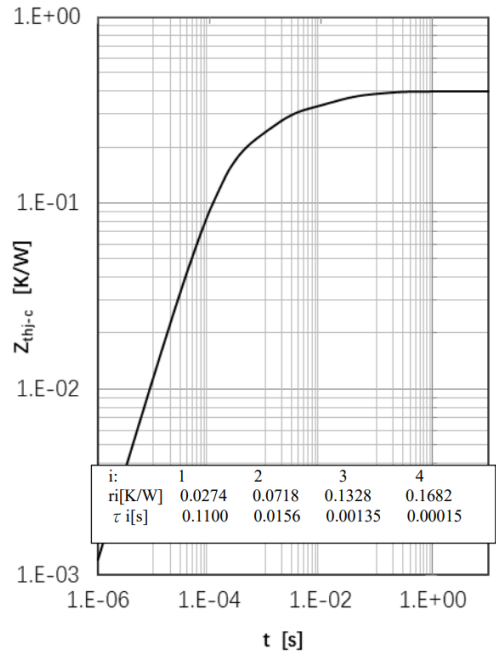


Figure 16. IGBT Transient Thermal Impedance

Typical Characteristics

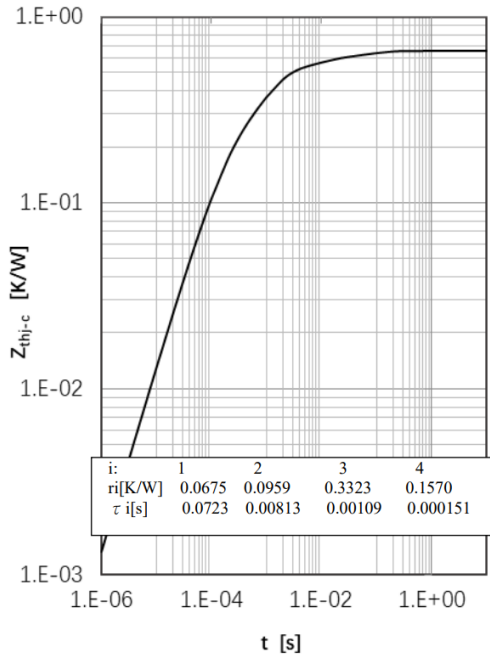


Figure 17. Diode Transient Thermal Impedance

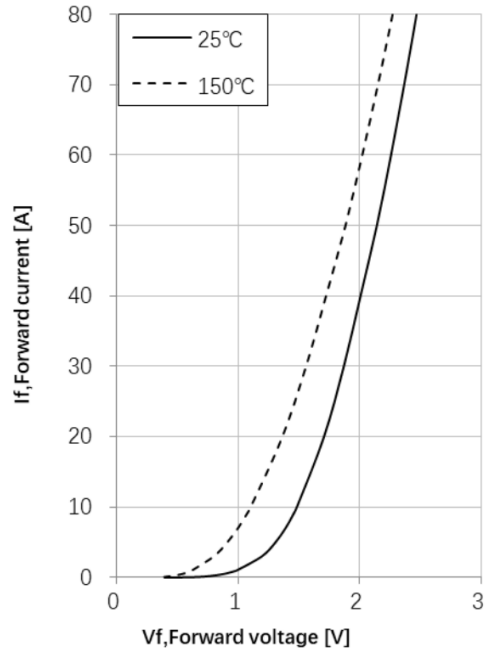


Figure 18. Diode forward current as a function of forward voltage

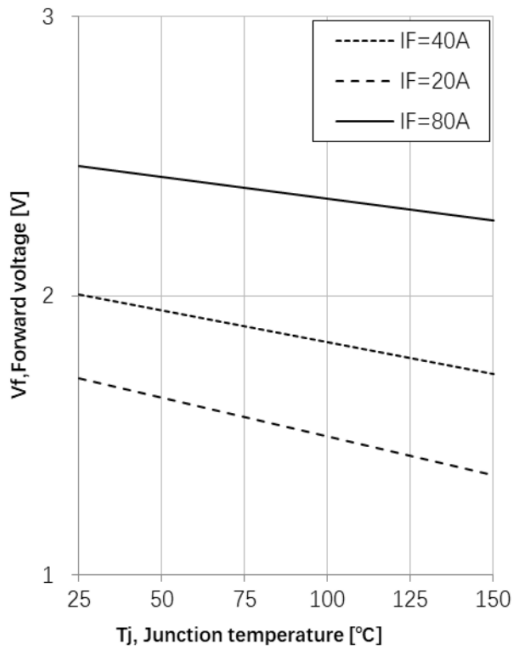
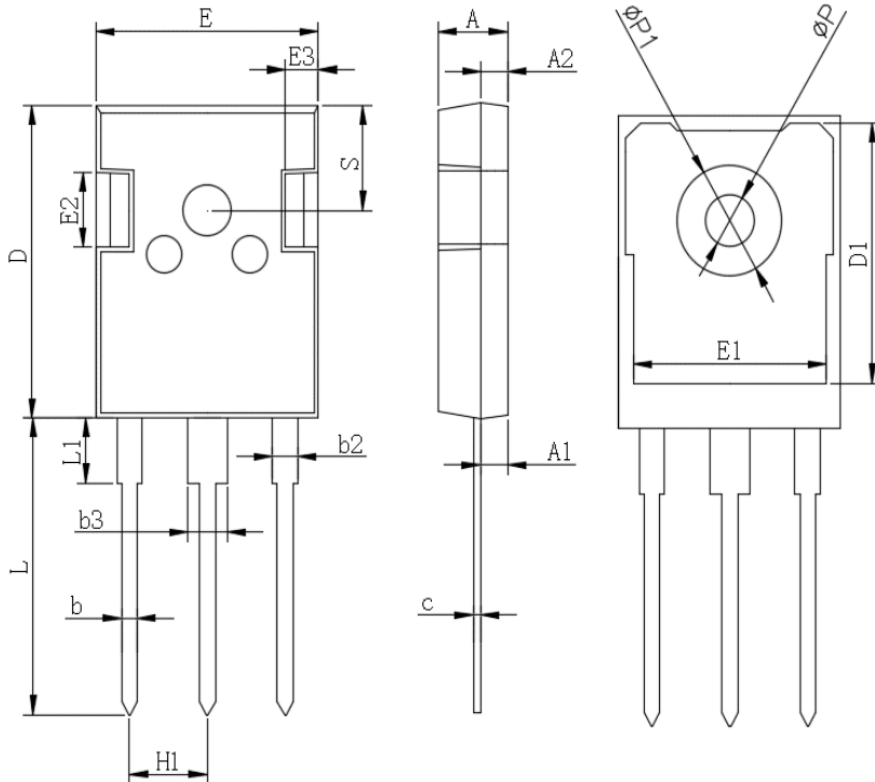


Figure 19. Diode forward voltage as a function of junction temperature

Package Outline

Unit : mm



SYMBOL	DIMENSIONS	
	MIN	MAX
A	4.80	5.20
A1	2.21	2.61
A2	1.85	2.15
b	1.0	1.4
b2	1.91	2.21
C	0.5	0.7
D	20.70	21.30
D1	16.25	16.85
E	15.50	16.10
E1	13.0	13.6
E2	4.80	5.20
E3	2.30	2.70
L	19.62	20.22
L1	-	4.30
ΦP	3.40	3.80
$\Phi P1$	-	7.30
S	6.15 Typ	
H1	5.44 Typ	
b3	2.80	3.20