

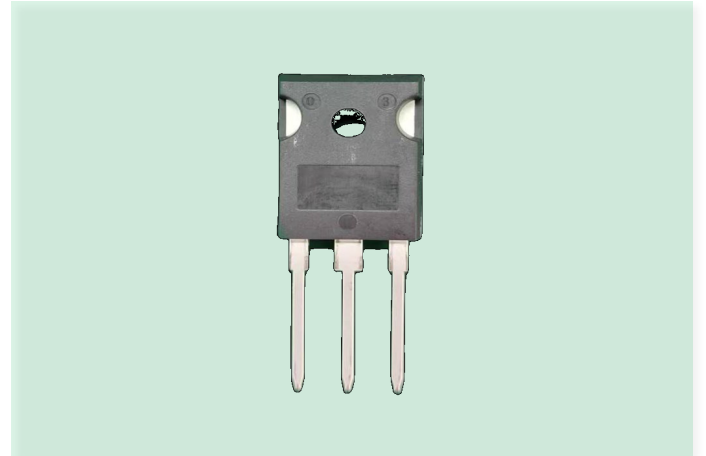
## IGBT

### Features/特性

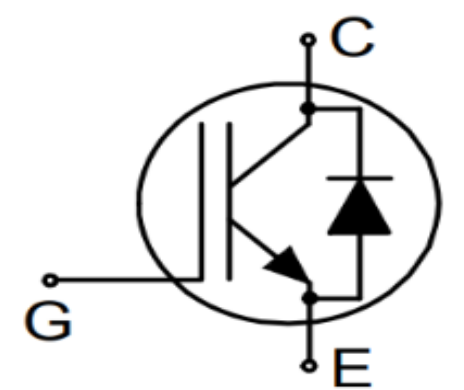
- 650V, 20A
- $V_{CE(sat)}(typ.)=2.0V @V_{GE}=15V, I_C=20A$
- 具有正温度系数的 $V_{CE(sat)}$   
 $V_{CE(sat)}$  with positive temperature coefficient
- 包括快速软恢复反并联前馈  
Including fast & soft recovery anti-parallel FWD
- 快开关速度  
High speed switching

### Applications/应用

- 不间断电源  
Uninterruptible power supply
- 电机驱动逆变器  
Inverter for motor drive
- 交、直流伺服驱动放大器  
AC and DC servo drive amplifier



### Equivalent Circuit Schematic/等效电路图



**IGBT-Absolute Maximum Ratings (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Value	Units
$V_{CES}$	Collector-Emitter Voltage 集电极-发射极电压	650	V
$V_{GES}$	Gate-Emitter Peak Voltage 栅极-发射极峰值电压	$\pm 30$	V
$I_C$	DC collector current, limited by $T_{vjmax}$ 集电极直流电流受最大结温限制	$T_C = 100^\circ\text{C}$ 20	A
$I_{CM}$	Pulsed collector current, $t_p$ limited by $T_{vjmax}$ 集电极脉冲电流脉宽受最大结温限制	60	A
$P_{tot}$	Maximum Power Dissipation 最大耗散功率	$T_C = 25^\circ\text{C}$ 48	W
		$T_C = 100^\circ\text{C}$ 24	W
$T_J$	Operating Junction Temperature 工作结温	-40 to 175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range 储存温度	-55 to 175	$^\circ\text{C}$

**IGBT Characteristics (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
$V_{CE\ sat}$	Collector to Emitter Saturation Voltage 集电极-发射极饱和电压	$I_C = 20\text{ A}, V_{GE} = 15\text{ V}$		2.0	2.5	V	
$V_{GE\ th}$	Gate-Emitter Threshold Voltage 栅极阈值电压	$I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$	4.0		6.0	V	
$I_{CES}$	Collector-Emitter Cut-off Current 集电极-发射极截止电流	$V_{CE} = 650\text{ V}, V_{GE} = 0\text{ V}$			100.0	$\mu\text{A}$	
$I_{GES}$	Gate-emitter Leakage Current 栅极-发射极漏电流	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			$\pm 200$	nA	
$Q_G$	Gate Charge 栅极电荷	$V_{CC}=520\text{V}, I_C=20\text{A}$ $V_{GE}=15\text{V}$		45		nC	
$Q_{GE}$	Gate-Emitter Charge 栅极-发射极电荷			13		nC	
$Q_{GC}$	Gate-Collector Charge 栅极-集电极电荷			20		nC	
$C_{ies}$	Input Capacitance 输入电容	$V_{CE}=25\text{V}, f=1\text{MHz},$ $V_{GE}=0\text{V}$		1040		nF	
$C_{oes}$	Output Capacitance 输出电容			47		nF	
$C_{res}$	Reverse Transfer Capacitance 反向传输电容			20		nF	
$t_{don}$	Turn-on Delay Time 开通延迟时间	$V_{CE}=400\text{V}, I_C=20\text{A},$ $R_G=15\ \Omega, V_{GE}=15\text{V}$		17		nS	
$t_r$	Rise Time 上升时间			30		nS	
$t_{doff}$	Turn-off Delay Time 关断延迟时间			72		nS	
$t_f$	Fall Time 下降时间			22		nS	
$E_{on}$	Turn-On Switching Loss Per Pulse 开通损耗能量				0.5		mJ
$E_{off}$	Turn-off Energy Loss Per Pulse 关断损耗能量				0.2		mJ

**Diode-Absolute Maximum Ratings (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Value	Units
$V_{RRM}$	Repetitive Peak Reverse Voltage 反向重复峰值电压	650	V
$I_F$	Diode Continuous Forward Current 连续正向直流电流	$T_C = 100^\circ\text{C}$ 20	A
$I_{FM}$	Diode maximum current, tp limited by Tvjmax 二极管最大电流, 脉宽受最大结温限制	60	A

**Diode Characteristics (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage 正向电压	$I_F = 40\text{ A}$		1.8		V
$Q_{rr}$	Recovered Charge 恢复电荷	$I_F = 40\text{ A}, V_{CE} = 400\text{ V}, R_G = 30\Omega$		863		nC
$I_{rr}$	Peak Reverse Recovery Current 反向恢复峰值电流			24		A
$t_{rr}$	Reverse Recovery Time 反向恢复时间			65		nS

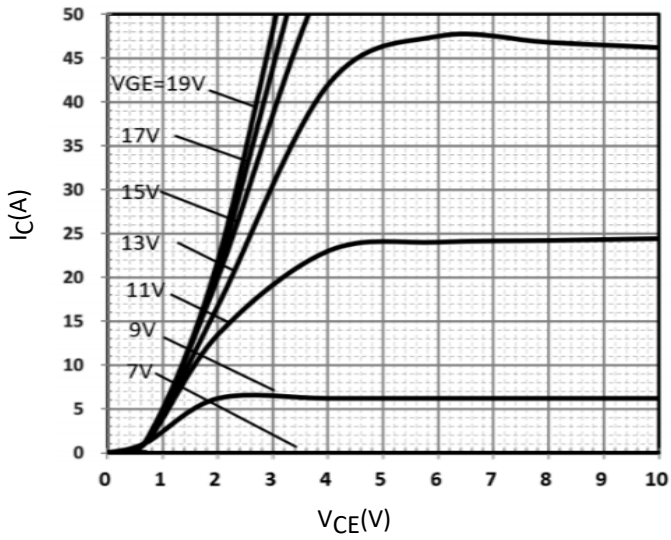
**Thermal Characteristics**

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{thJC}$	Thermal resistance, junction to case for IGBT IGBT 结-外壳热阻			3.1	$^\circ\text{C}/\text{W}$
$R_{thJC}$	Thermal resistance, junction to case for Diode 二极管 结-外壳热阻			3.8	$^\circ\text{C}/\text{W}$
$R_{thJA}$	Thermal resistance, junction to Ambient 结-环境热阻			63	$^\circ\text{C}/\text{W}$

输出特性IGBT

Typical output characteristic IGBT

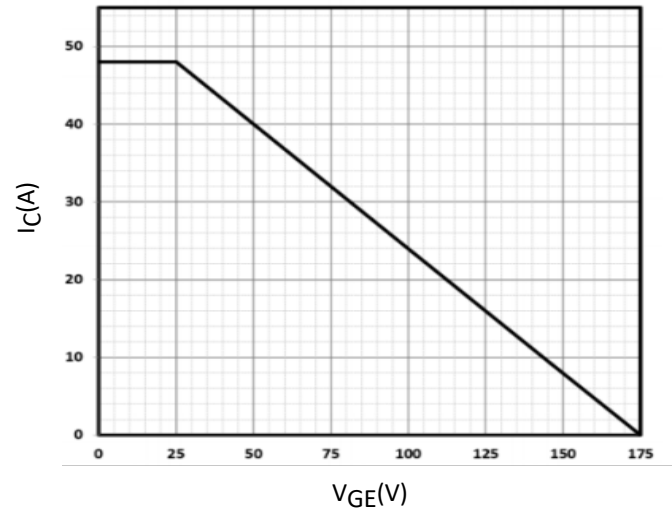
$I_C = f(V_{CE})$   
 $T_{vj} = 25^\circ\text{C}$



传输特性IGBT

Typical transfer characteristic IGBT

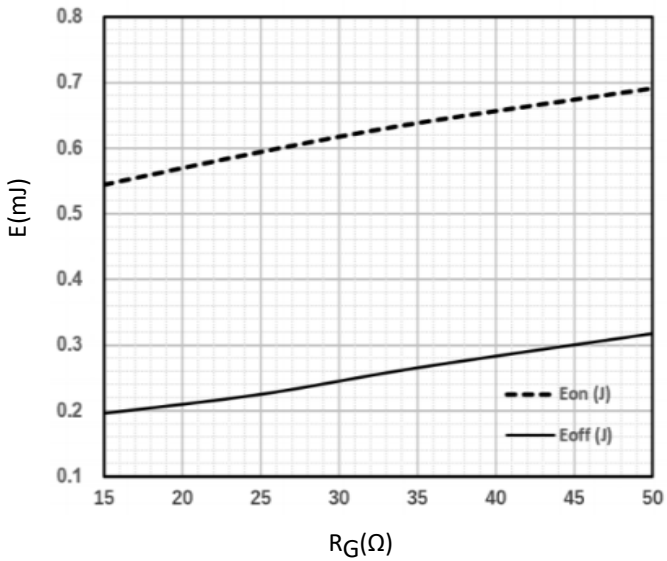
$I_C = f(V_{GE})$   
 $T_{vj} = 25^\circ\text{C}$



开关损耗IGBT

output characteristic IGBT

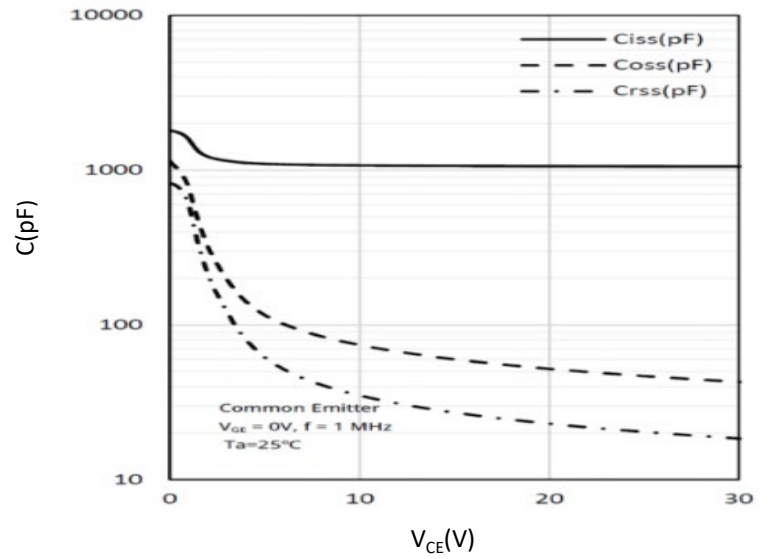
$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = 15\text{V}, I_C = 20\text{A}, V_{CE} = 400\text{V}$



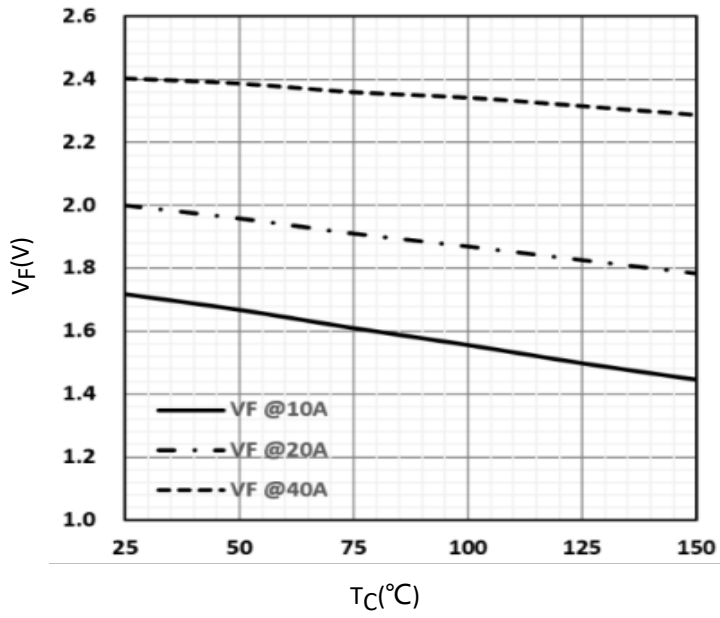
电容

capacitance as a function of collector-emitter voltage IGBT

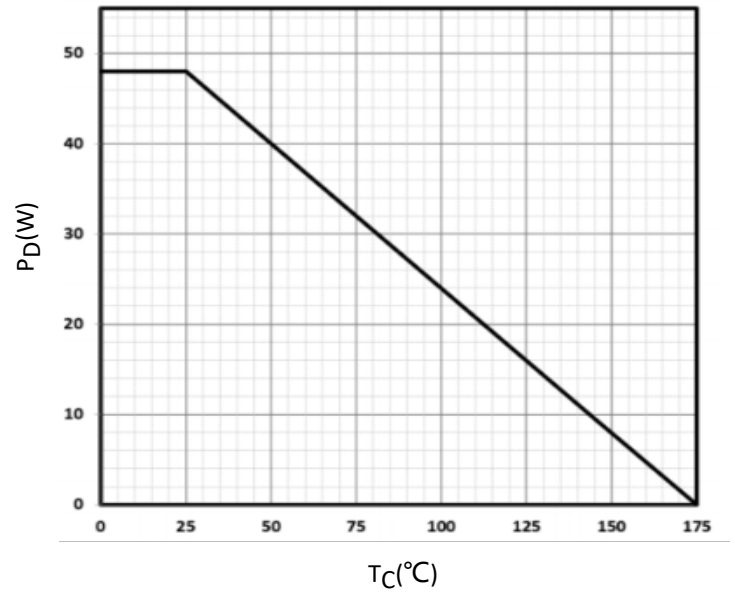
$C = f(V_{CE}), f = 1\text{MHz}, V_{GE} = 0\text{V}$   
 $T_{vj} = 25^\circ\text{C}$



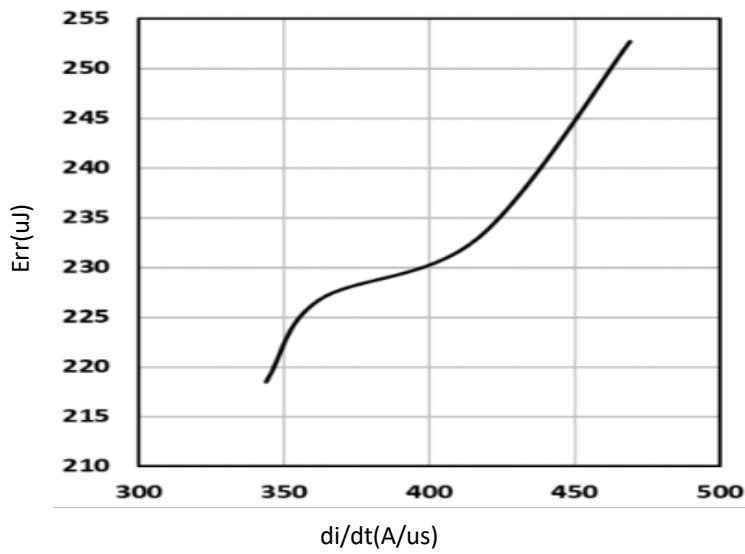
正向偏压二极管  
Diode forward voltage as a function of junction temperature  
 $V_F=f(T_C)$



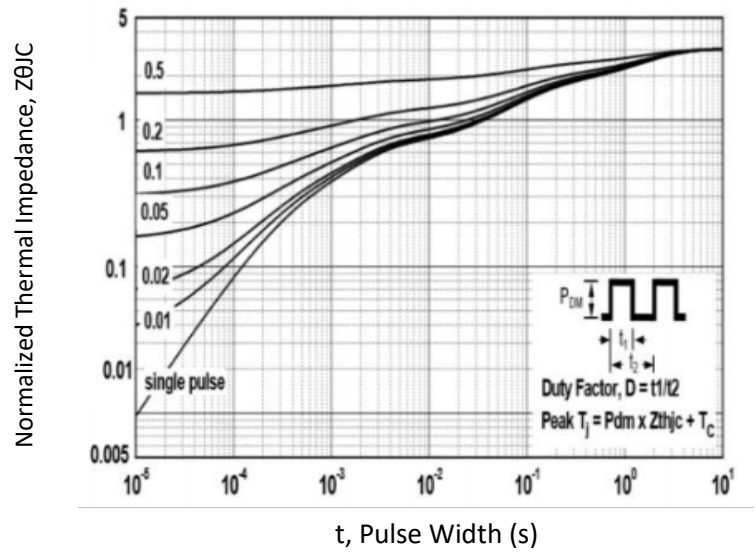
功耗  
Power dissipation as a function of case temperature  
 $P_D=f(T_C)$



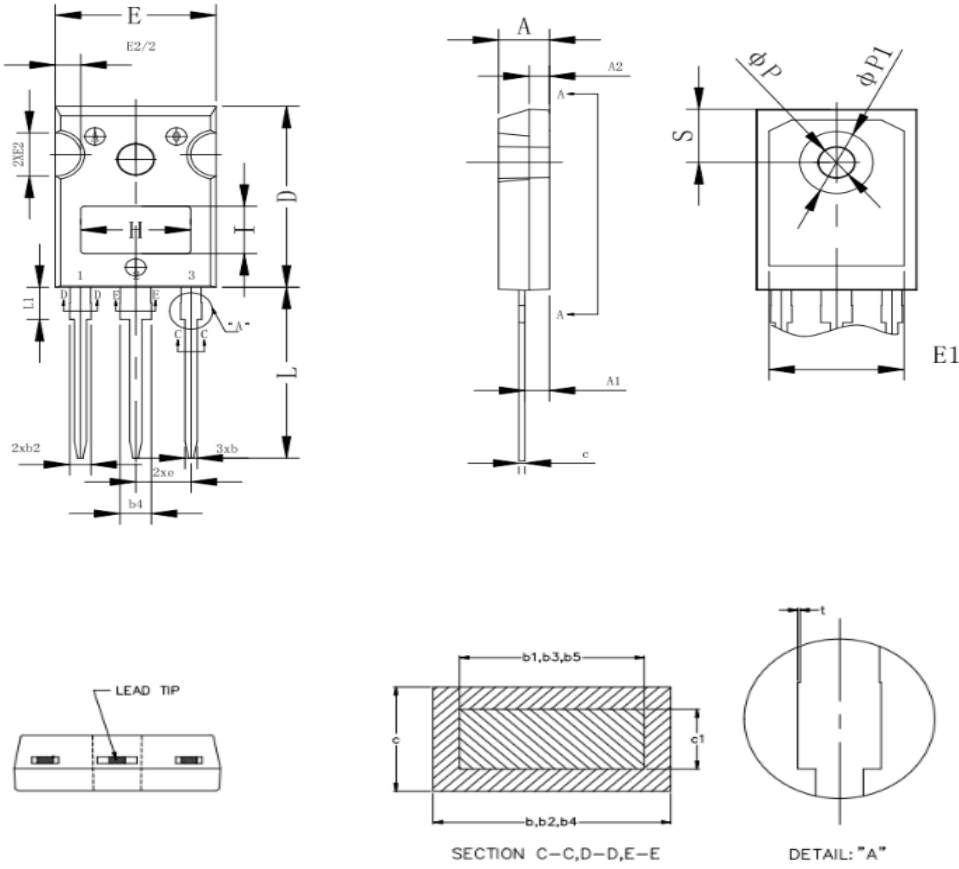
开关损耗二极管  
Switching losses Diode  
 $Err = f(di/dt)$   
 $V_{GE}=15V, I_C=20A, V_{CE}=400V$



瞬态热阻抗  
normalized transient thermal impedance, junction to case  
 $Z_{thjc}=f(t)$



## 封装尺寸/package outlines



SYMBOLS	DIMENSIONS			
	mm		inch	
	Min.	Max.	Min.	Max.
A	4.9	5.1	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	1.96	2.06	0.077	0.081
b3	1.95	2.02	0.077	0.080
b4	2.96	3.06	0.117	0.120
b5	2.95	3.02	0.116	0.119
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.75	15.90	0.620	0.626
E1	13.26	-	0.552	-
E2	4.90	5.10	0.193	0.201
e	5.44BSC		0.214BSC	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
φP	3.5	3.7	0.138	0.146
φP1	-	7.40	-	0.291
S	6.05	6.25	0.238	0.246
t	0.00	0.15	0.000	0.006
H	10.6	11.2	0.417	0.441
I	5.3	5.7	0.209	0.224