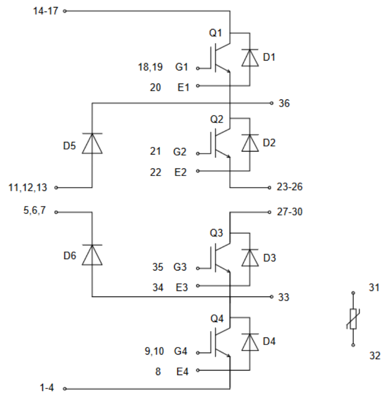
产品外观 / Appearance:



V_{CES} = 650V

$I_{C\ nom}$ = 450A / I_{CRM} = 900A

Solar Power 2 封装

I 型三电平/ Three Level (I - type)

特性 / Features:

- 中点钳位三电平逆变模块
- 650V 场终止技术 IGBT5
- 低电感布局

- Neutral Point Clamped Three−Level Inverter Module
- 650V Field Stop IGBT5
- Low Inductive Layout

应用 / Applications

- 光伏逆变器
- UPS 系统
- 三电平应用

- Solar Inverters
- Uninterruptable Power Supplies Systems
- 3-Level-Applications

外管 IGBT (Q1-1, Q1-2, Q4-1, Q4-2) / OUTER IGBT (Q1-1, Q1-2, Q4-1, Q4-2)

最大额定值 / Maximum Rated Values

集电极－发射极电压 Collector-emitter voltage	T_j = 25 ℃	V_{CES}	650	V
有效工作电流 Implemented collector current		I_{CN}	225	A
连续集电极直流电流 Continuous DC collector current	T_C = 80 ℃, $T_{j\ max}$ = 175 ℃	$I_{C\ nom}$	148	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1ms	I_{CRM}	450	A
总功率损耗 Total power dissipation	T_C = 25 ℃, $T_{j\ max}$ = 175 ℃	P_D	650	W
栅极－发射极峰值电压 Gate- emitter peak voltage		V_{GES}	+/-20	V

特征值 / Characteristic Values

				min.	typ.	max.	
集电极－发射极饱和电压 Collector-emitter saturation voltage	I_C = 225A, V_{GE} = 15V I_C = 225A, V_{GE} = 15V	T_j = 25 ℃ T_j = 150 ℃	$V_{CE\ sat}$		1.75 1.95	2.0	V V
栅极阈值电压 Gate threshold voltage	I_C = 2.75 mA, V_{CE} = V_{GE}, T_j = 25 ℃		V_{GEth}	3.5	4.5	5.5	V
栅极电荷 Gate charge	V_{CE} = 520V, I_C = 225A, V_{GE} = ±15V		Q_G		519		nC
输入电容 Input capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}		17.1		nF
输出电容 Output capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{oes}		1.407		nF
反向传输电容 Reverse transfer capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{res}		0.117		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{GE} = 0V, V_{CE} = 650V, T_j = 25 ℃		I_{CES}			1.0	mA
栅极-发射极漏电流 Gate-emitter leakage current	V_{GE} = 20V, V_{CE} = 0V, T_j = 25 ℃		I_{GES}			600	nA
开通延迟时间 Turn-on delay time	V_{CE} = 400V, I_C = 100A V_{GE} = 0V to +15V, R_{Gon} = 12Ω, R_{Goff} = 12Ω, Inductive Load	T_j = 25 ℃ T_j = 125 ℃	$t_{d\ on}$		115 107		ns ns
上升时间 Rise Time		T_j = 25 ℃ T_j = 125 ℃	t_r		48 52		ns ns
关断延迟时间 Turn-Off Delay Time		T_j = 25 ℃ T_j = 125 ℃	$t_{d\ off}$		693 738		ns ns
下降时间 Fall Time		T_j = 25 ℃ T_j = 125 ℃	t_f		61 62		ns ns
开通能量损耗 Turn-on energy loss		T_j = 25 ℃ T_j = 125 ℃	E_{on}		4.02 5.24		mJ mJ
关断损耗能量 Turn-off energy loss		T_j = 25 ℃ T_j = 125 ℃	E_{off}		3.26 3.60		mJ mJ
结－外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			0.23	K/W
在开关状态下温度 Temperature under switching conditions			$T_{j\ op}$	-40		175	℃

内管 IGBT (Q2, Q3) / INNER IGBT (Q2, Q3)

最大额定值 / Maximum Rated Values

集电极一发射极电压 Collector-emitter voltage	T_j = 25 ℃	V_{CES}	650	V
有效工作电流 Implemented collector current		I_{CN}	375	A
连续集电极直流电流 Continuous DC collector current	T_C = 80 ℃, $T_{j\ max}$ = 175 ℃	$I_{C\ nom}$	278	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1ms	I_{CRM}	750	A
总功率损耗 Total power dissipation	T_C = 25 ℃, $T_{j\ max}$ = 175 ℃	P_D	1070	W
栅极一发射极峰值电压 Gate- emitter peak voltage		V_{GES}	+/-20	V

特征值 / Characteristic Values

				min.	typ.	max.	
集电极一发射极饱和电压 Collector-emitter saturation voltage	I_C = 375A, V_{GE} = 15V I_C = 375A, V_{GE} = 15V	T_j = 25 ℃ T_j = 150 ℃	$V_{CE\ sat}$		1.40 1.75	2.0	V V
栅极阈值电压 Gate threshold voltage	I_C = 3.75 mA, V_{CE} = V_{GE}, T_j = 25 ℃		V_{GEth}	3.5	4.5	5.5	V
栅极电荷 Gate charge	V_{CE} = 520V, I_C = 375A, V_{GE} = ±15V		Q_G		865		nC
输入电容 Input capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{ies}		28.7		nF
输出电容 Output capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{oes}		1.19		nF
反向传输电容 Reverse transfer capacitance	f = 1MHz, T_j = 25 ℃, V_{CE} = 25V, V_{GE} = 0V		C_{res}		0.200		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{GE} = 0V, V_{CE} = 650V, T_j = 25 ℃		I_{CES}			1.0	mA
栅极-发射极漏电流 Gate-emitter leakage current	V_{GE} = 20V, V_{CE} = 0V, T_j = 25 ℃		I_{GES}			1000	nA
开通延迟时间 Turn-on delay time	V_{CE} = 400V, I_C = 100A V_{GE} = 0V to +15V, R_{Gon} = 12Ω, R_{Goff} = 12Ω, Inductive Load	T_j = 25 ℃ T_j = 125 ℃	$t_{d\ on}$		173 162		ns ns
上升时间 Rise Time		T_j = 25 ℃ T_j = 125 ℃	t_r		59 70		ns ns
关断延迟时间 Turn-Off Delay Time		T_j = 25 ℃ T_j = 125 ℃	$t_{d\ off}$		1149 1289		ns ns
下降时间 Fall Time		T_j = 25 ℃ T_j = 125 ℃	t_f		49 44		ns ns
开通能量损耗 Turn-on energy loss		T_j = 25 ℃ T_j = 125 ℃	E_{on}		3.03 3.89		mJ mJ
关断损耗能量 Turn-off energy loss		T_j = 25 ℃ T_j = 125 ℃	E_{off}		3.66 4.41		mJ mJ
结一外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}			0.14	K/W
在开关状态下温度 Temperature under switching conditions			$T_{j\ op}$	-40		175	℃

二极管 (D1, D2, D3, D4) / Diode (D1, D2, D3, D4)

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_j = 25$ ℃	V_{RRM}	650	V
连续正向直流电流 Continuous DC forward current		I_F	150	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1$ms	I_{FRM}	300	A

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	$I_F = 150$A, $V_{GE} = 0$V	$T_j = 25$ ℃ $T_j = 125$ ℃	V_F		1.60 1.70	2.30	V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 100$A, $V_R = 400$ V $V_{GE} = 0$V to 15V	$T_j = 25$ ℃ $T_j = 125$ ℃	I_{RM}		60 68		A A
恢复电荷 Recovered charge		$T_j = 25$ ℃ $T_j = 125$ ℃	Q_{rr}		4.55 7.54		µC
反向恢复损耗 Reverse recovery energy		$T_j = 25$ ℃ $T_j = 125$ ℃	E_{rec}		1.01 1.83		mJ
结－外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			0.43	K/W
在开关状态下温度 Temperature under switching conditions			$T_{j\ op}$	-40		175	℃

二极管 (D5, D6) / Diode (D5, D6)

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_j = 25$ ℃	V_{RRM}	650	V
连续正向直流电流 Continuous DC forward current		I_F	375	A
正向重复峰值电流 Repetitive peak forward current	$t_P = 1$ms	I_{FRM}	750	A

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	$I_F = 375$A, $V_{GE} = 0$V	$T_j = 25$ ℃ $T_j = 125$ ℃	V_F		1.65 1.85	2.30	V V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 100$A, $V_R = 400$ V $V_{GE} = 0$V to 15V	$T_j = 25$ ℃ $T_j = 125$ ℃	I_{RM}		67 80		A A
恢复电荷 Recovered charge		$T_j = 25$ ℃ $T_j = 125$ ℃	Q_r		5.5 10.1		µC
反向恢复损耗 Reverse recovery energy		$T_j = 25$ ℃ $T_j = 125$ ℃	E_{rec}		1.1 2.2		mJ
结－外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}			0.17	K/W
在开关状态下温度 Temperature under switching conditions			$T_{j\ op}$	-40		175	℃

负温度系数热敏电阻 / NTC-Thermistor

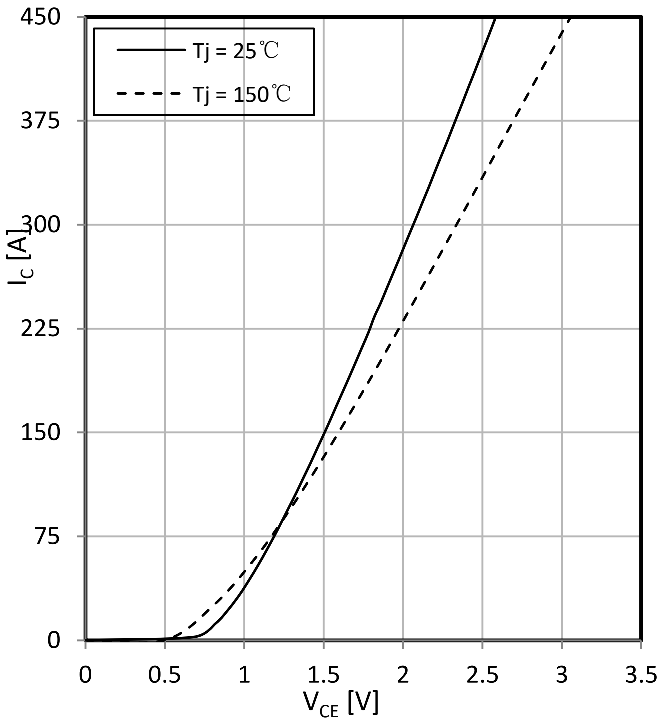
特征值 / Characteristic Values

			min.	typ.	max.	
额定电阻值 Rated resistance	T_c = 25 ℃	R_{25}		22		kΩ
R100 偏差 Deviation of R100	T_c = 100 ℃, R100 = 1486Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_c = 25 ℃	P_{25}			200	mW
B-值 B-value	$R_2 = R_{25}\exp[B_{25/50}(1/T_2 – 1/(298,15\ K))]$	$B_{25/50}$		3950		K
B-值 B-value	$R_2 = R_{25}\exp[B_{25/100}(1/T_2 – 1/(298,15\ K))]$	$B_{25/100}$		4000		K

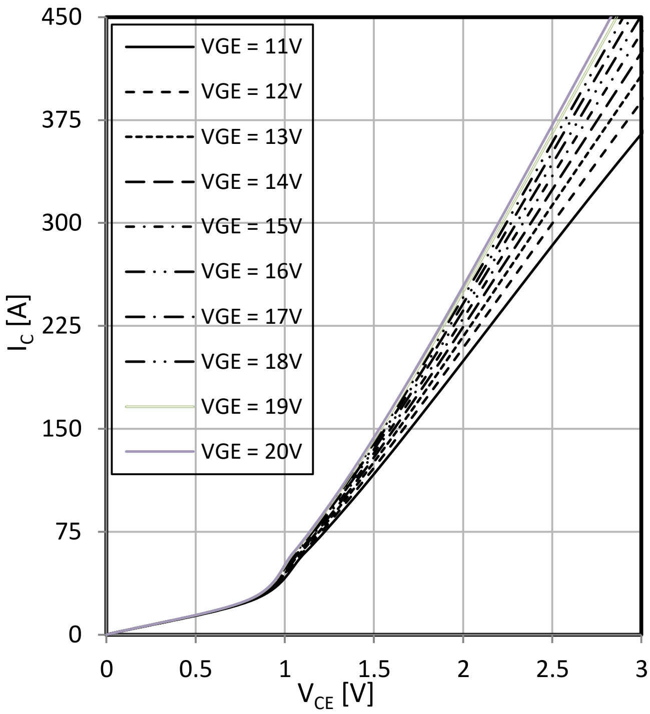
模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50Hz, t = 1 min.	V_{ISOL}		3.2		kV
模块基板材料 Material of module baseplate				Cu		
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) Basic insulation (class1, IEC 61140)			Al_2O_3		
储存温度 Storage temperature		T_{stg}	-40		125	℃

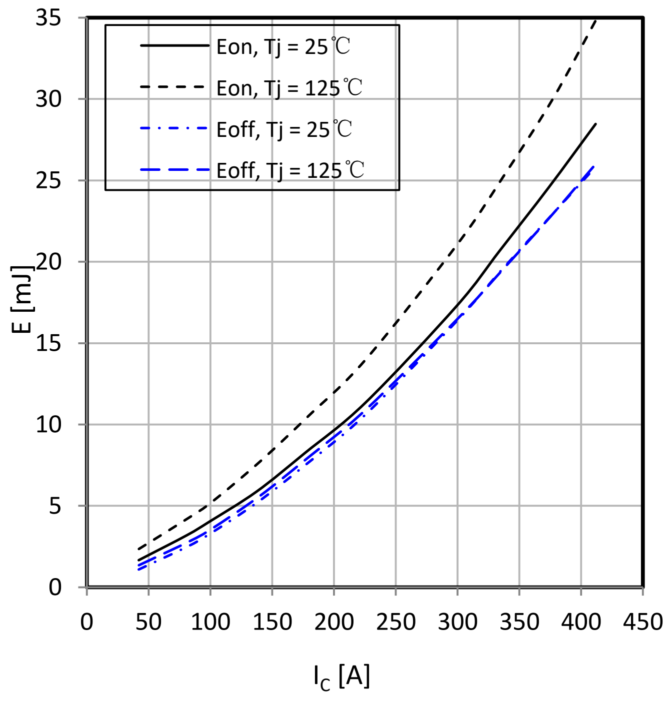
输出特性 IGBT，（典型）Q1-1, Q1-2, Q4-1, Q4-2
Output characteristic IGBT, (typical) Q1-1, Q1-2, Q4-1, Q4-2
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



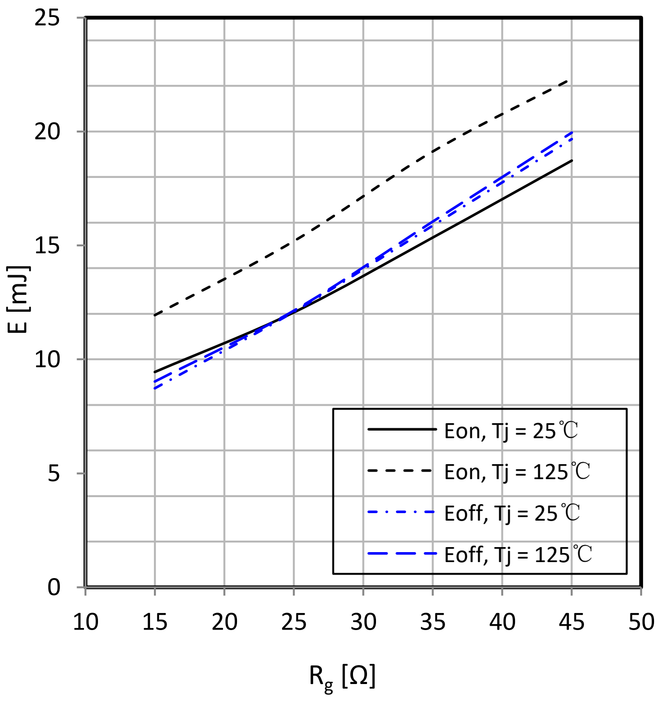
输出特性 IGBT，（典型）Q1-1, Q1-2, Q4-1, Q4-2
Output characteristic IGBT, (typical) Q1-1, Q1-2, Q4-1, Q4-2
$I_C = f(V_{CE})$
$T_j = 150$℃



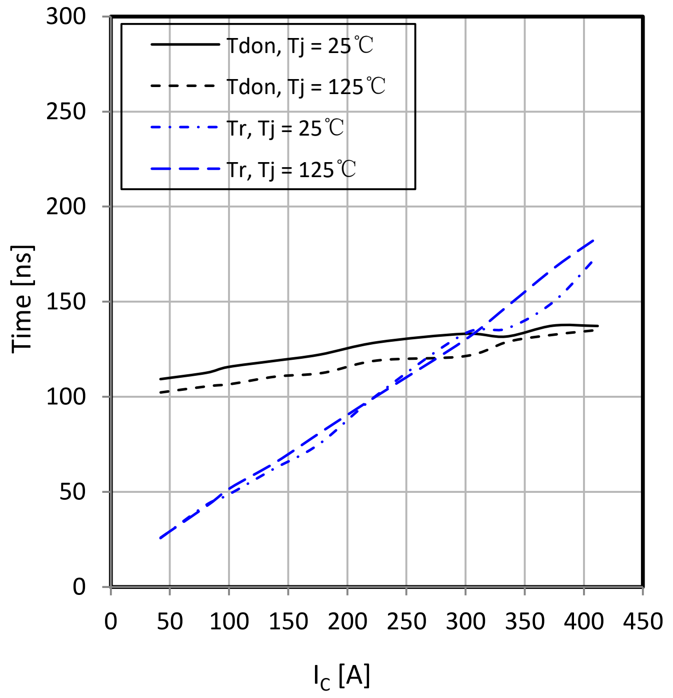
开关损耗 IGBT，（典型）Q1, Q4
Switching losses IGBT, (typical) Q1, Q4
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$,
$V_{GE} = +15$ V to 0V, $R_{Gon} = 12\ \Omega$, $R_{Goff} = 12\ \Omega$, $V_{CE} = 400$ V



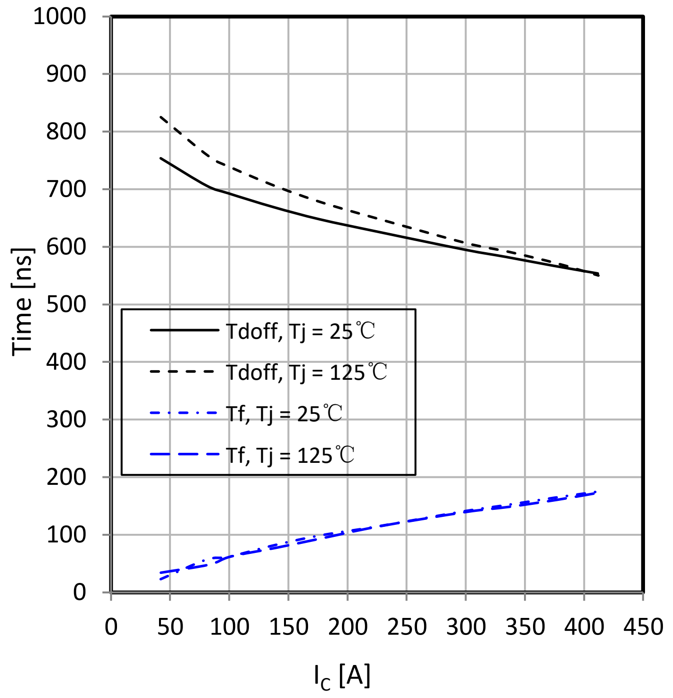
开关损耗 IGBT，（典型）Q1, Q4
Switching losses IGBT, (typical) Q1, Q4
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$,
$V_{GE} = +15$ V to 0V, Ic=180A, $V_{CE} = 400$ V



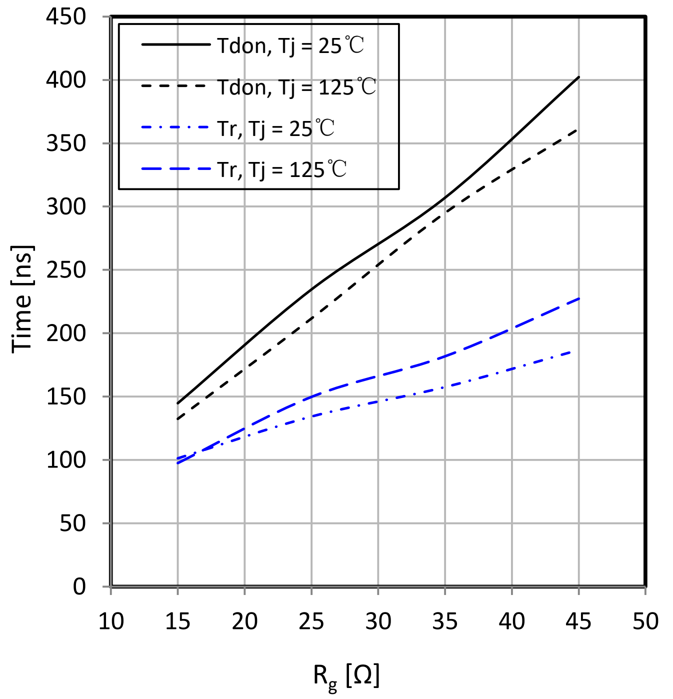
开关时间 IGBT，（典型）Q1, Q4
Switching times IGBT, (typical) Q1, Q4
t = f (I_C)
V_{GE} = +15 V to 0V, R_{Gon} = 12 Ω, R_{Goff} =12 Ω, V_{CE} = 400 V



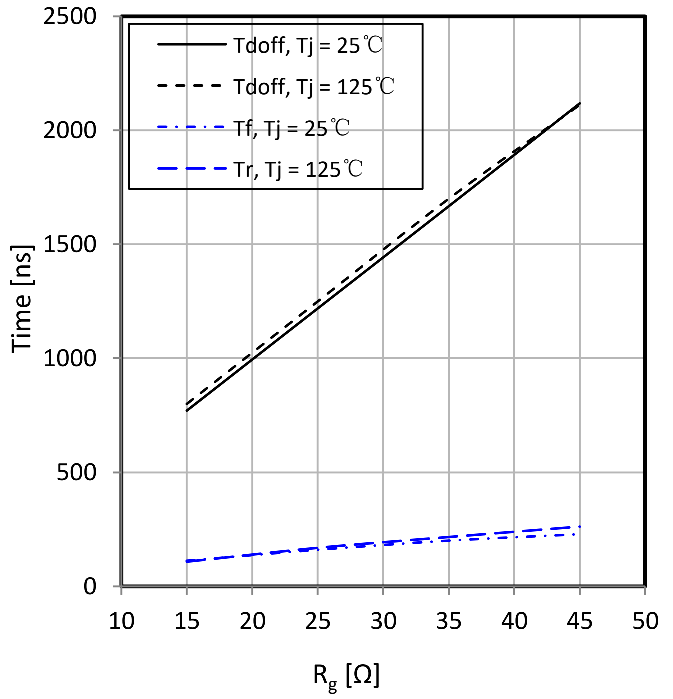
开关时间 IGBT，（典型）Q1, Q4
Switching times IGBT, (typical) Q1, Q4
t = f (I_C)
V_{GE} = +15 V to 0V, R_{Gon} = 12 Ω, R_{Goff} =12 Ω, V_{CE} = 400 V



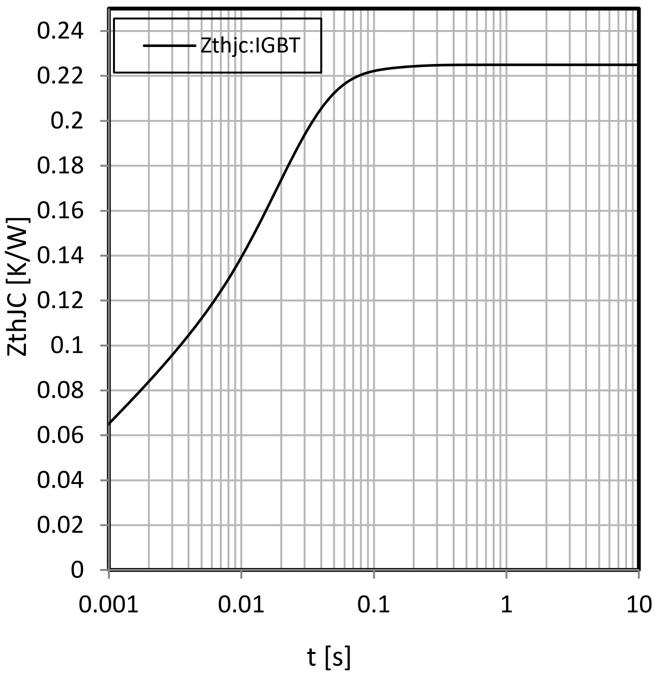
开关时间 IGBT，（典型）Q1, Q4
Switching times IGBT, (typical) Q1, Q4
t = f (R_G)
V_{GE} = +15 V to 0V, Ic=180A, V_{CE} = 400 V



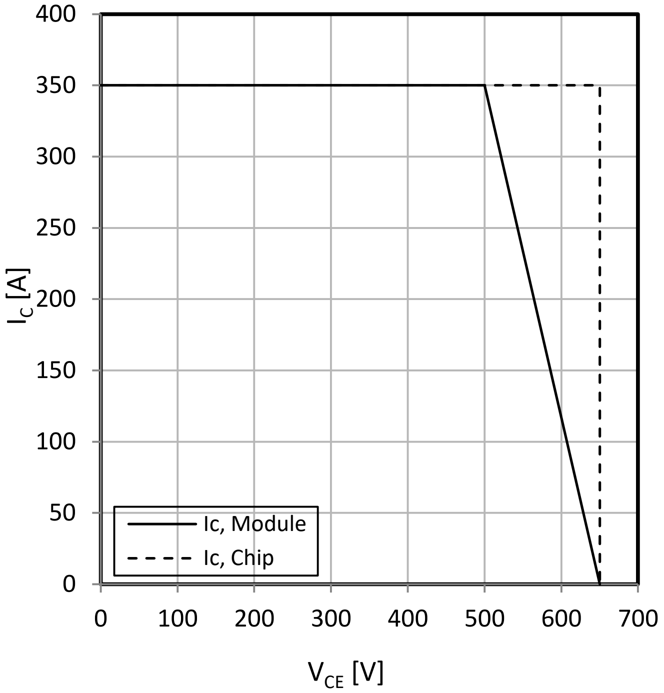
开关时间 IGBT，（典型）Q1, Q4
Switching times IGBT, (typical) Q1, Q4
t = f (R_G)
V_{GE} = +15 V to 0V, Ic=180A, V_{CE} = 400 V



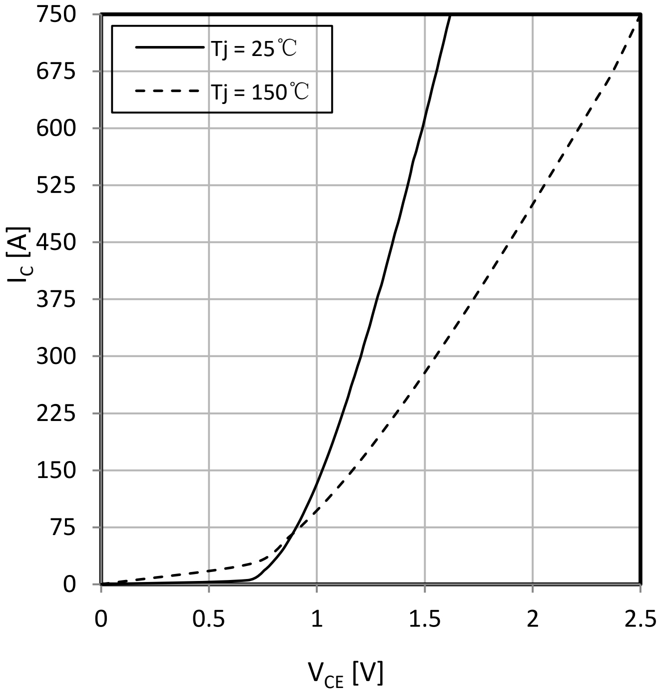
瞬态热阻抗 IGBT，（典型）Q1-1, Q1-2, Q4-1, Q4-2
Transient thermal impedance IGBT, (typical) Q1-1, Q1-2, Q4-1, Q4-2
Z_{thJC} = f (t)



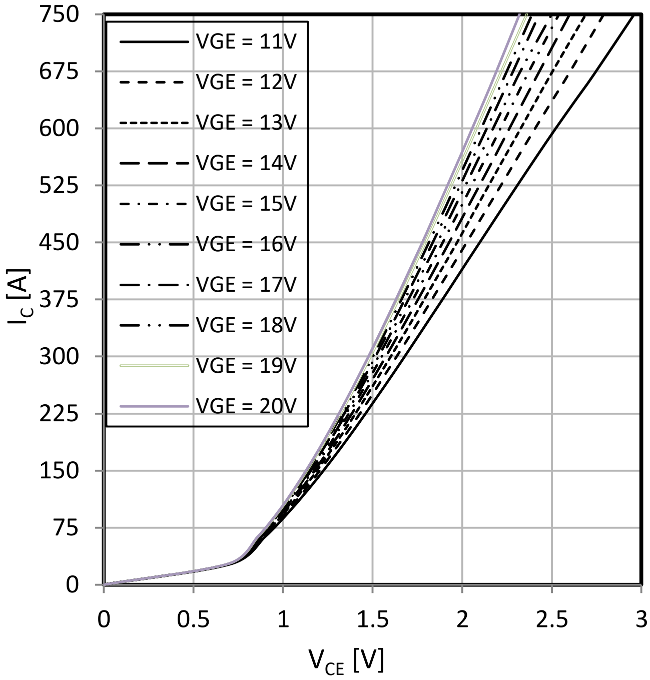
反偏安全工作区 IGBT，（RBSOA）Q1-1, Q1-2, Q4-1, Q4-2
Reverse bias operating area IGBT, (RBSOA) Q1-1, Q1-2, Q4-1, Q4-2
I_C = f (V_{CE})
V_{GE} = +15 V to 0V, R_{Goff} =12 Ω, Tj = 150℃



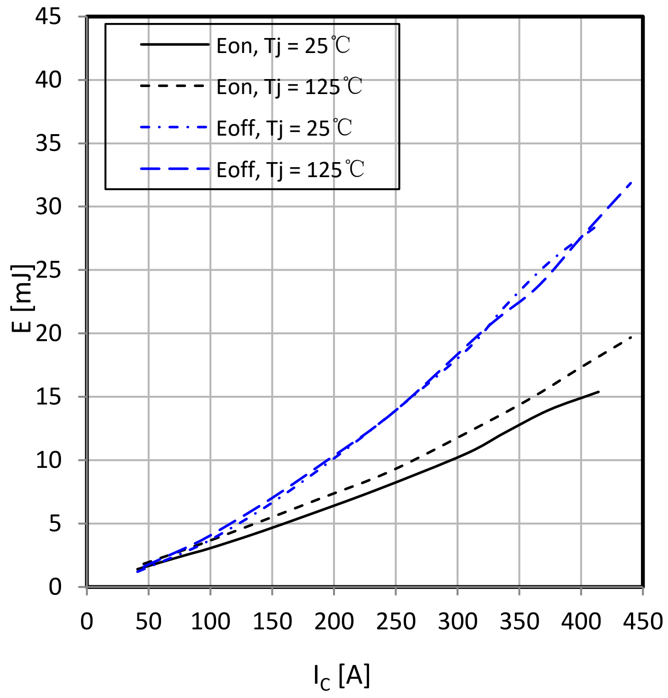
输出特性 IGBT，（典型）Q2, Q3
Output characteristic IGBT, (typical) Q2, Q3
I_C = f (V_{CE})
V_{GE} = 15 V



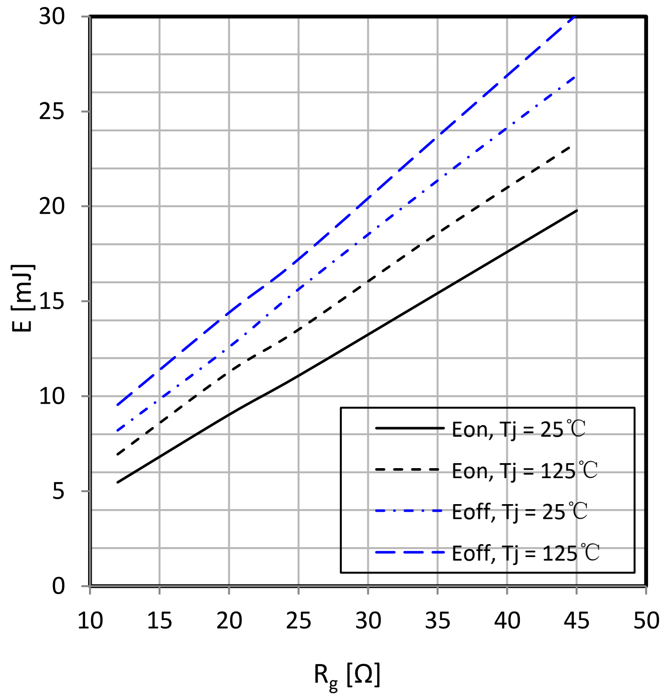
输出特性 IGBT，（典型）Q2, Q3
Output characteristic IGBT, (typical) Q2, Q3
I_C = f (V_{CE})
T_j = 150℃



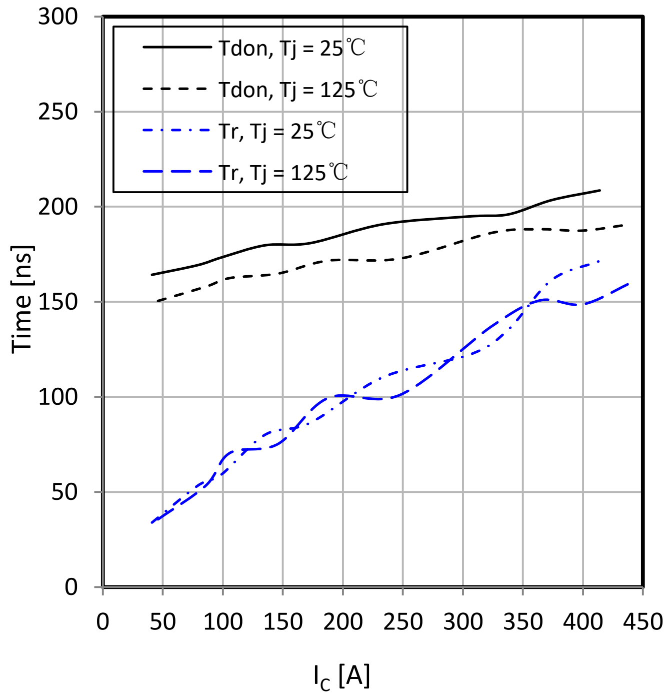
开关损耗 IGBT，（典型）Q2, Q3
Switching losses IGBT, (typical) Q2, Q3
E_{on} = f (I_C), E_{off} = f (I_C),
V_{GE} = +15 V to 0V, R_{Gon} = 12 Ω, R_{Goff} =12 Ω, V_{CE} = 400 V



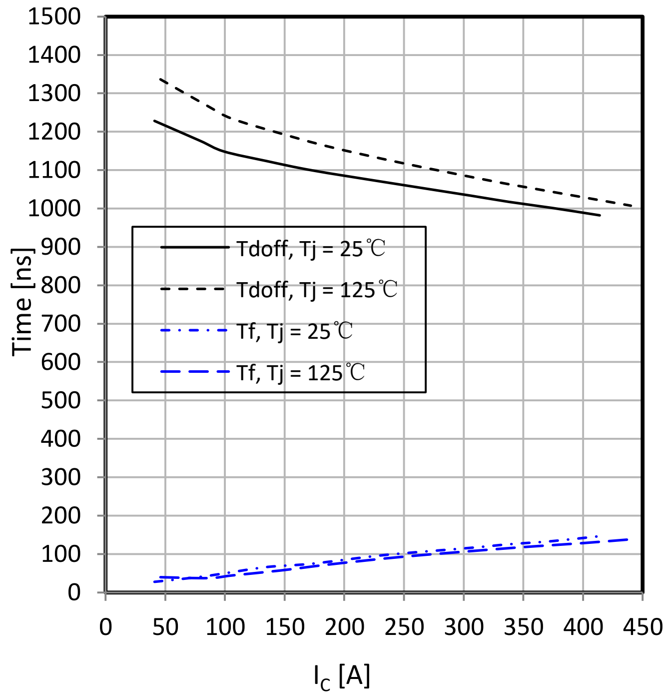
开关损耗 IGBT，（典型）Q2, Q3
Switching losses IGBT, (typical) Q2, Q3
E_{on} = f (R_G), E_{off} = f (R_G),
V_{GE} = +15 V to 0V, Ic=180A, V_{CE} = 400 V



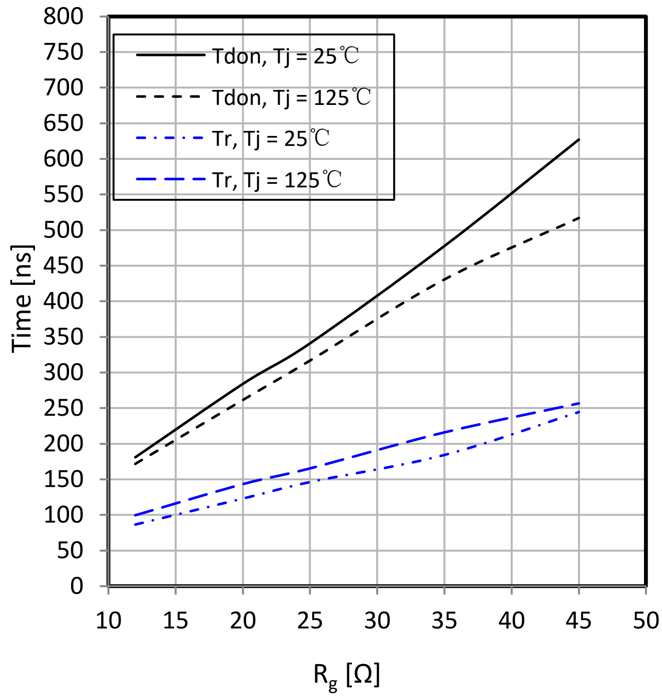
开关时间 IGBT，（典型）Q2, Q3
Switching times IGBT, (typical) Q2, Q3
t = f (I_C)
V_{GE} = +15 V to 0V, R_{Gon} = 12 Ω, R_{Goff} =12 Ω, V_{CE} = 400 V



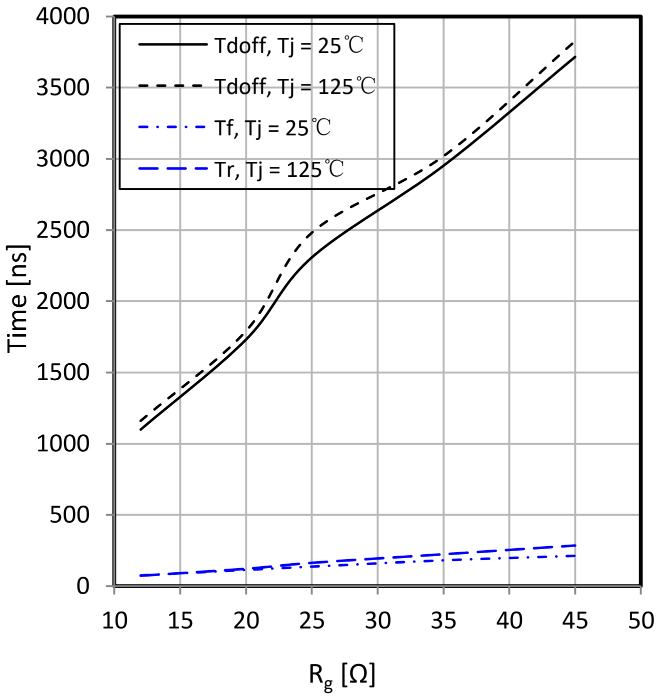
开关时间 IGBT，（典型）Q2, Q3
Switching times IGBT, (typical) Q2, Q3
t = f (I_C)
V_{GE} = +15 V to 0V, R_{Gon} = 12 Ω, R_{Goff} =12 Ω, V_{CE} = 400 V



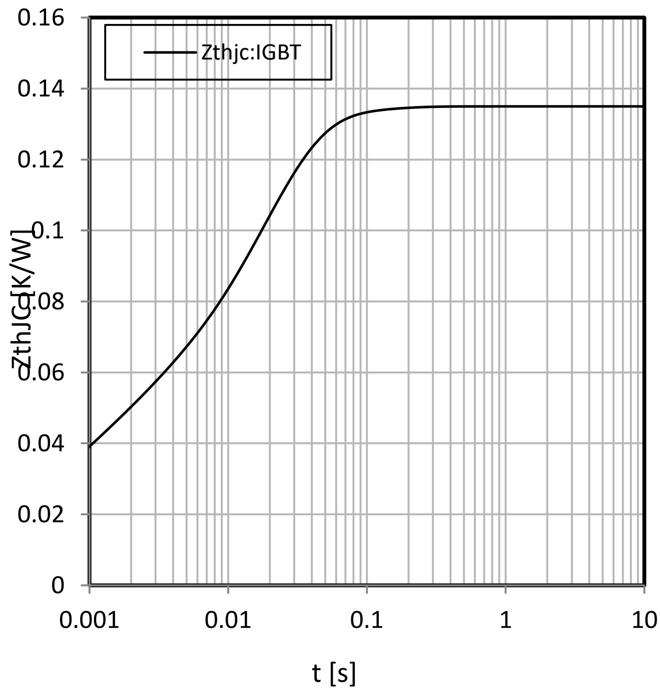
开关时间 IGBT，（典型）Q2, Q3
Switching times IGBT, (typical) Q2, Q3
t = f (R_G)
V_{GE} = +15 V to 0V, Ic=180A, V_{CE} = 400 V



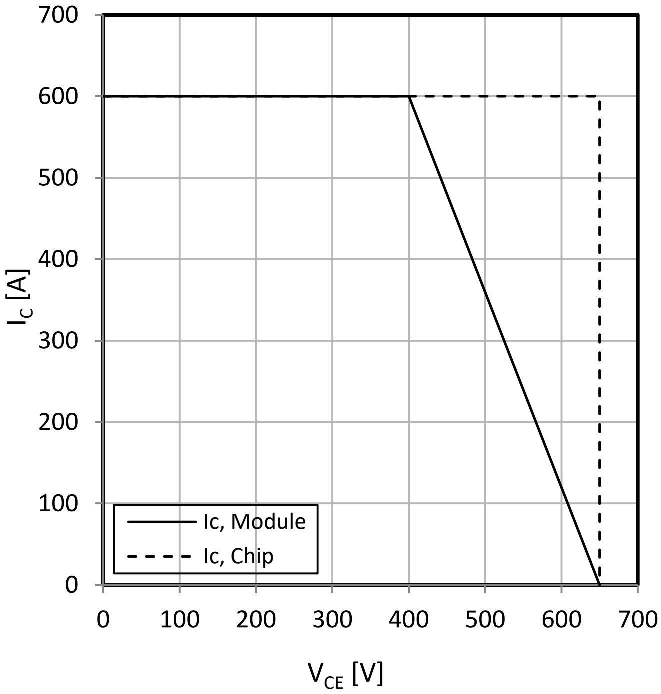
开关时间 IGBT，（典型）Q2, Q3
Switching times IGBT, (typical) Q2, Q3
t = f (R_G)
V_{GE} = +15 V to 0V, Ic=180A, V_{CE} = 400 V



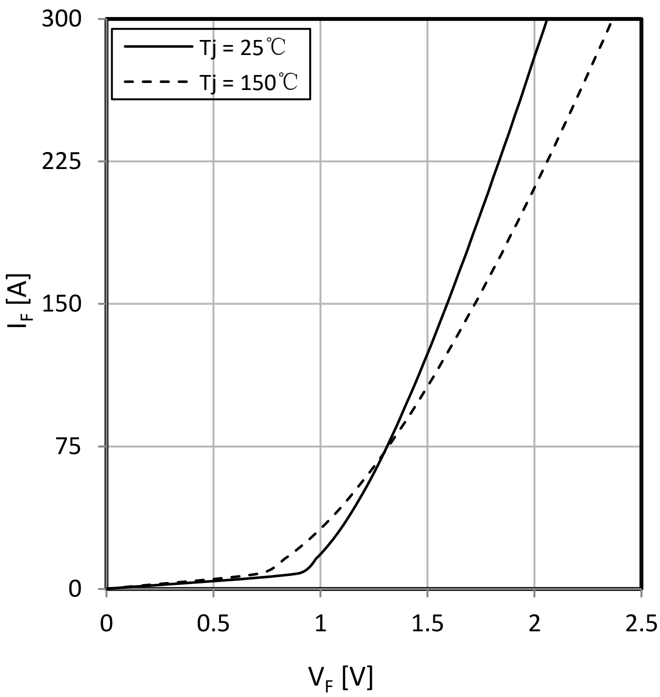
瞬态热阻抗 IGBT，（典型）Q2, Q3
Transient thermal impedance IGBT, (typical) Q2, Q3
Z_{thJC} = f (t)



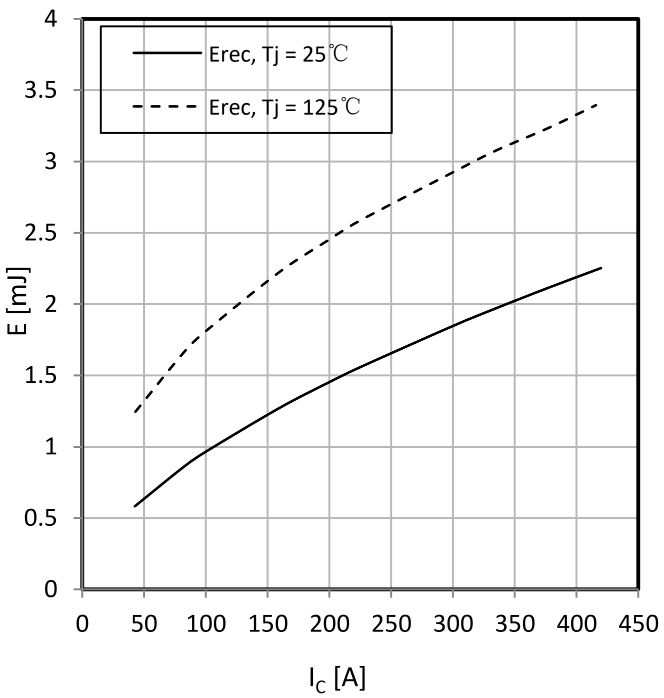
反偏安全工作区 IGBT，（RBSOA）Q2, Q3
Reverse bias operating area IGBT, (RBSOA) Q2, Q3
I_C = f (V_{CE})
V_{GE} = +15 V to 0V, R_{Goff} =12 Ω, Tj = 150℃



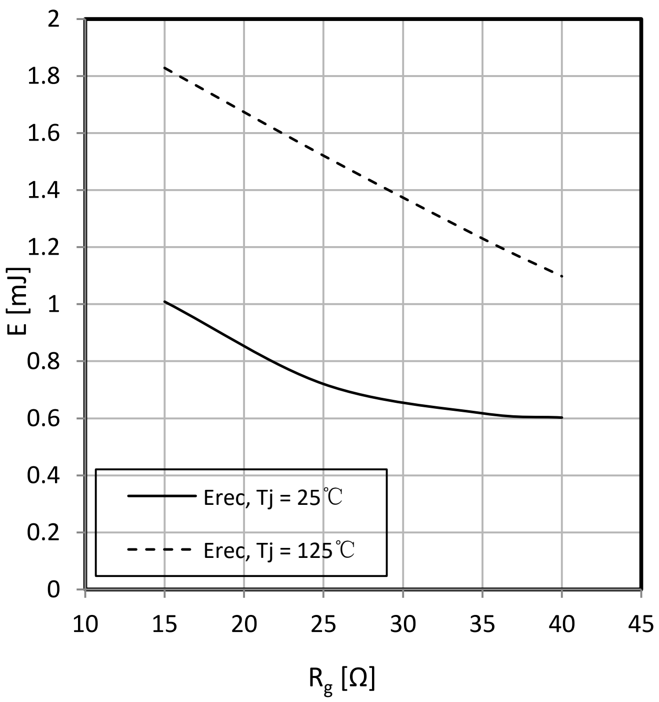
正向偏压特性 二极管，（典型）D1, D2, D3, D4
Forward characteristic of Diode, (typical) D1, D2, D3, D4
$I_F = f(V_F)$



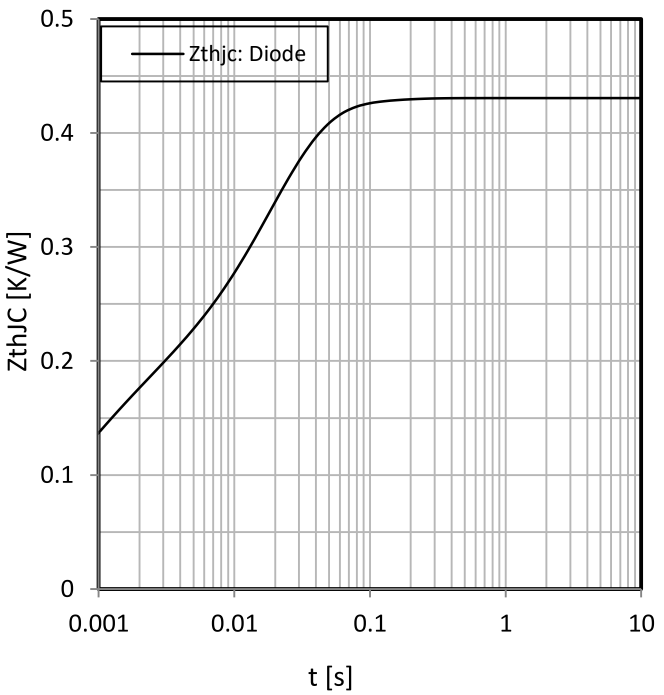
开关损耗 二极管，（典型）D1, D2, D3, D4
Switching losses Diode, (typical) D1, D2, D3, D4
$E_{rec} = f(I_F)$
R_{Gon} =15 Ω, V_{CE} = 400 V



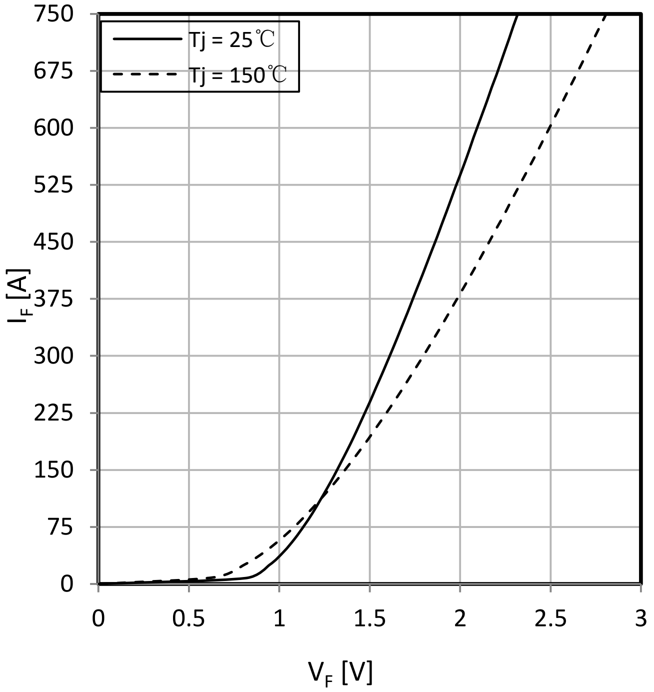
开关损耗 二极管，（典型）D1, D2, D3, D4
Switching losses Diode, (typical) D1, D2, D3, D4
$E_{rec} = f(R_g)$,
I_F = 100 A, V_{CE} = 600 V



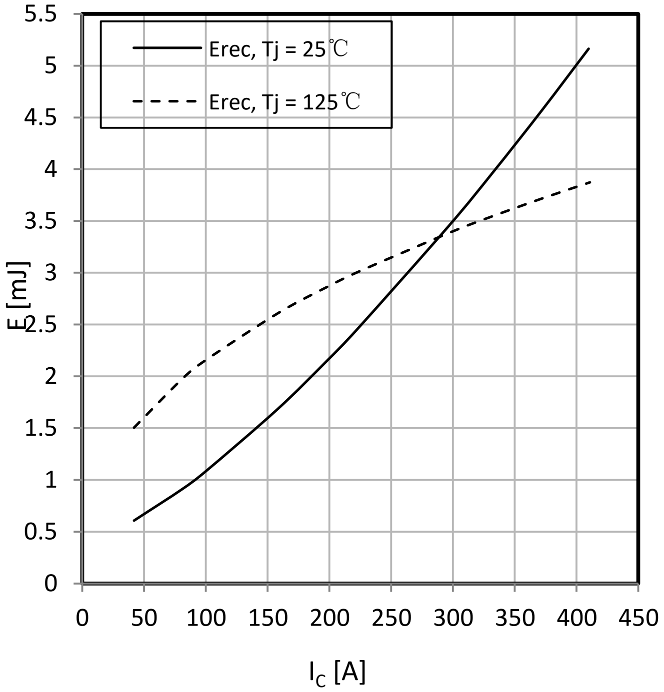
瞬态热阻抗 二极管，（典型）D1, D2, D3, D4
Transient thermal impedance Diode, (typical) D1, D2, D3, D4
$Z_{thJC} = f(t)$



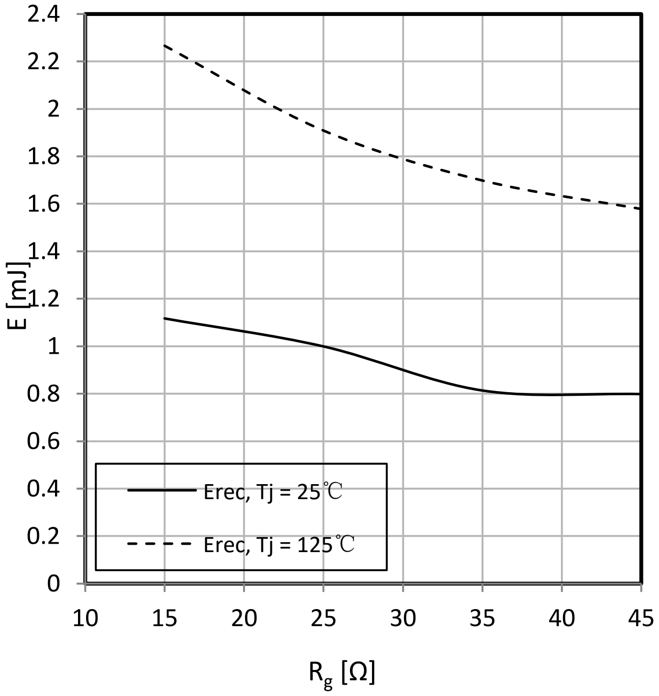
正向偏压特性 二极管,（典型）D5, D6
Forward characteristic of Diode, (typical) D5, D6
$I_F = f(V_F)$



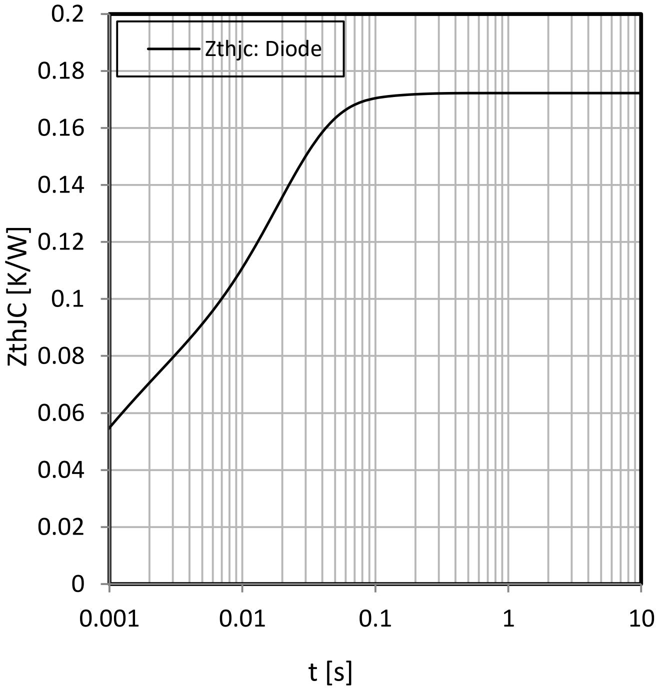
开关损耗 二极管,（典型）D5, D6
Switching losses Diode, (typical) D5, D6
$E_{rec} = f(I_F)$
R_{Gon} =15 Ω, V_{CE} = 400 V



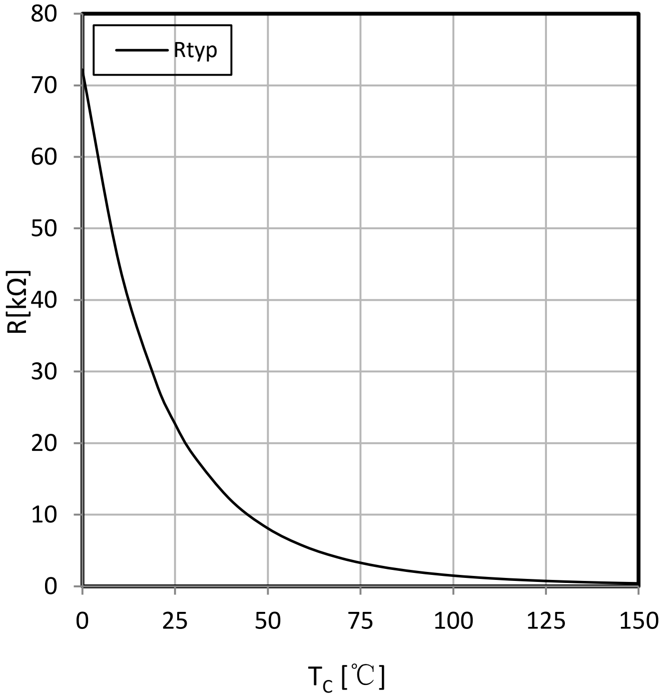
开关损耗 二极管,（典型）D5, D6
Switching losses Diode, (typical) D5, D6
$E_{rec} = f(R_g)$,
I_F = 100 A, V_{CE} = 600 V



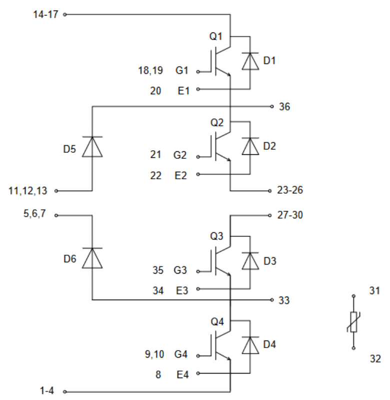
瞬态热阻抗 二极管,（典型）D5, D6
Transient thermal impedance Diode, (typical) D5, D6
$Z_{thJC} = f(t)$



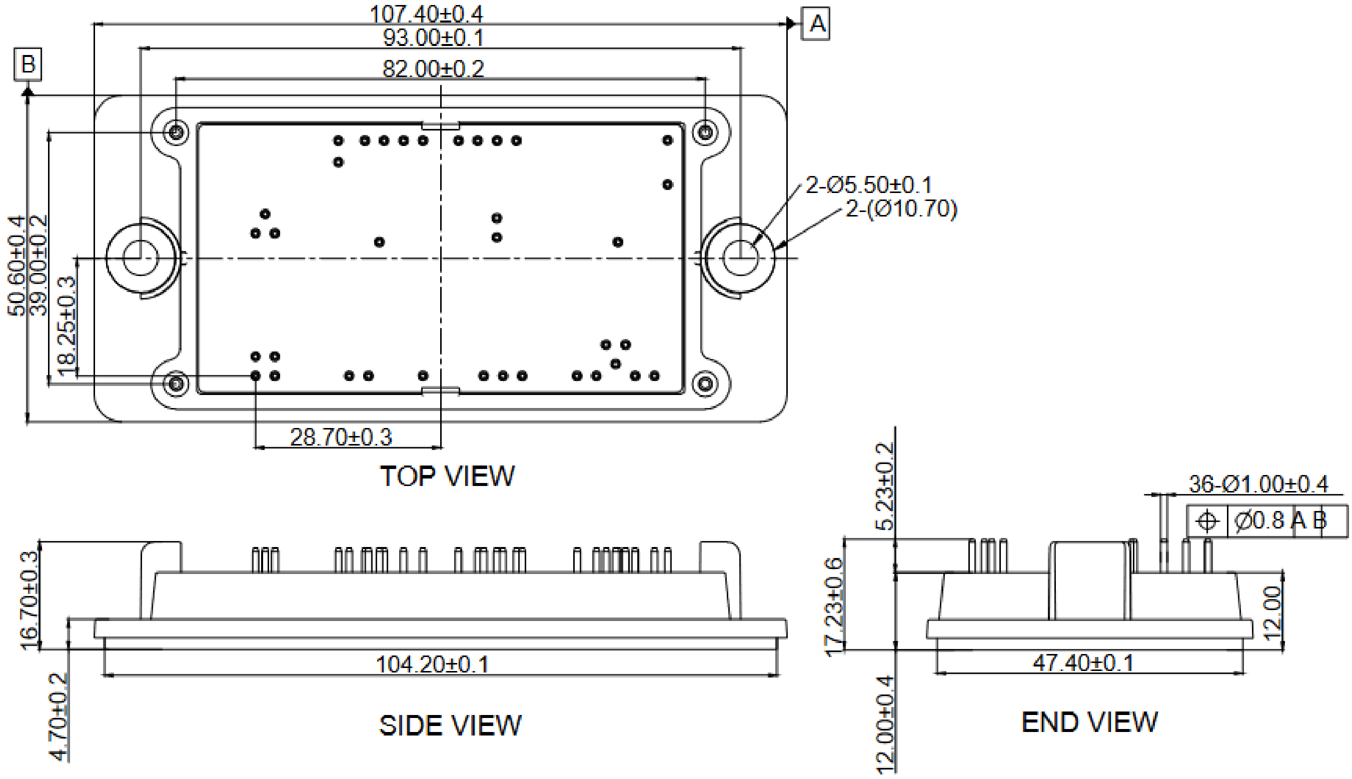
负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)
R = f(T)

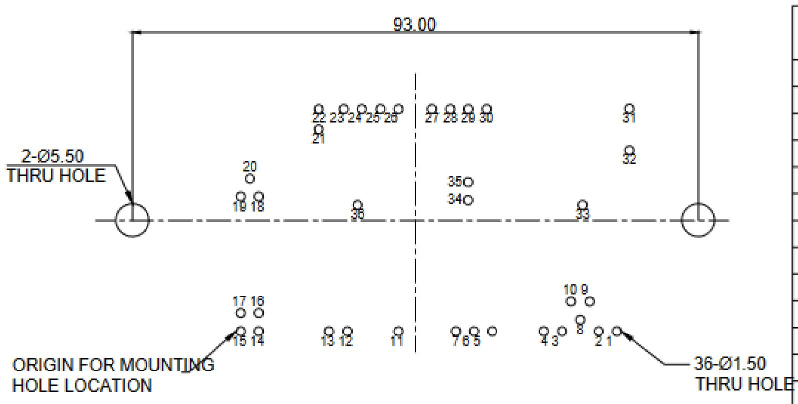


接线图 / Circuit Diagram



封装尺寸 / Package Outlines





RECOMMENDED MOUNTING PATTERN*

PIN	PIN POSITION X	Y
1	61.85	0.0
2	58.85	0.0
3	52.85	0.0
4	49.85	0.0
5	41.35	0.0
6	38.35	0.0
7	35.35	0.0
8	55.85	1.85
9	57.35	4.85
10	54.35	4.85
11	25.95	0.0
12	17.5	0.0
13	14.5	0.0
14	3.0	0.0
15	0.0	0.0
16	3.0	3.0
17	0.0	3.0
18	3.0	22.1

PIN	PIN POSITION X	Y
19	0.0	22.1
20	1.5	25.1
21	12.85	33.15
22	12.85	36.5
23	16.95	36.5
24	19.95	36.5
25	22.95	36.5
26	25.95	36.5
27	31.45	36.5
28	34.45	36.5
29	37.45	36.5
30	40.45	36.5
31	63.9	36.55
32	63.9	29.7
33	56.2	20.75
34	37.4	21.5
35	37.4	24.5
36	19.2	20.75

警告:

1. 在性能上超过设备的最高额定值可能会对设备造成损坏，甚至永久故障，这可能会影响机器的可靠性。建议在设备最高额定值的80%以下使用。
2. 安装散热器时，请注意散热片的扭转力矩和平滑度。
3. IGBT 是一种对静电敏感的器件，使用时必须保护其免受静电的破坏。
4. 本刊物由华润微电子制作，如有定期更改，恕不另行通知。

Warnings:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. It is suggested to be used under 80 percent of the maximum ratings of the device.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. This publication is made by CR Microelectronics and subject to regular change without notice.