

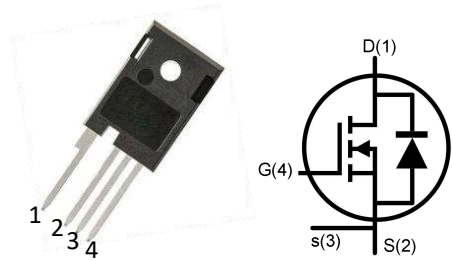
HCM40S12T4K2

1200V 40mΩ 碳化硅功率MOSFET, TO-247-4L

1200V 40mΩ Silicon Carbide Power MOSFET, TO-247-4L

特点 Features

- 高阻断电压，低导通电阻
High Blocking Voltage with Low On-Resistance
- 高开关速度，低寄生电容
High Speed Switching with Low Capacitances
- 易于并联，驱动简单
Easy to Parallel and Simple to Drive
- 抗门锁效应
Resistant to Latch-Up
- 无卤素添加，符合RoHS标准
Halogen Free, RoHS Compliant
- AEC-Q101认证通过
AEC-Q101 Qualified



应用 Applications

- 电动汽车充电桩
EV Charging Station
- PFC及DC/DC转换
Power Factor Correction or DC/DC Converters
- 光伏逆变器
Solar Inverters
- 电机驱动系统
Motor Drives
- 开关模式电源（SMPS）
Switch Mode Power Supplies

碳化硅功率MOSFET/ SiC Power MOSFET

最大额定值/ Maximum Rated Values ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
漏极-源极电压 Drain-source voltage	$V_{DS\ max}$	$V_{GS}=0V, I_D=100\mu A$	1200	V
栅极-源极电压 Gate-source voltage	$V_{GS\ max}$	Absolute maximum values	-10/+22	V
	$V_{GS\ op}$	Recommended operational values	-5/+18	V
连续漏极电流 Continuous drain current	I_D	$V_{GS}=18V, T_c=25^{\circ}\text{C}$	82	A
		$V_{GS}=18V, T_c=100^{\circ}\text{C}$	58	
漏极脉冲电流 Pulsed drain current	$I_{D\ pulse}$	Pulse width t_p limited by $T_{vj\ max}$	246	A
耗散功率 Power dissipation	P_D	$T_c=25^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	417	W
工作结温 Operating junction temperature	$T_{vj\ op}$		-55~175	$^{\circ}\text{C}$
存储温度范围 Storage temperature range	T_{stg}		-55~175	$^{\circ}\text{C}$

电特性 Electrical Characteristics ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition		数值 Value			单位 Unit
				Min.	Typ.	Max.	
漏极-源极阻断电压 Drain-source breakdown voltage	V _{DSS BR}	V _{GS} =0V, I _D =100μA		1200			V
栅极阈值电压 Gate threshold voltage	V _{GS th}	V _{DS} =V _{GS} , I _D =10mA	T _{vj} =25℃	2.0	3.2	4.0	V
			T _{vj} =175℃		2.3		
零栅压漏极电流 Zero gate voltage drain current	I _{DSS}	V _{DS} =1200V, V _{GS} =0V			1	100	μA
栅极-源极漏电流 Gate-source leakage current	I _{GSS}	V _{GS} =18V, V _{DS} =0V			1	100	nA
漏极-源极导通电阻 Drain-source on-state resistance	R _{DS on}	V _{GS} =18V, I _D =40A	T _{vj} =25℃		40	55	mΩ
			T _{vj} =175℃		62		
跨导 Transconductance	g _{fs}	V _{DS} =20V, I _D =40A	T _{vj} =25℃		27.6		S
			T _{vj} =175℃		21		
输入电容 Input capacitance	C _{iss}	V _{GS} =0V V _{DS} =1000V f=100kHz V _{AC} =25mV			3030		pF
输出电容 Output capacitance	C _{oss}				125		
反向传输电容 Reverse transfer capacitance	C _{rss}				10		
输出电容存储能量 C _{oss} stored energy	E _{oss}				135		μJ
开通能量 Turn-on switching energy	E _{on}	V _{DS} =800V, V _{GS} =-5/18V I _D =40A, R _{G ext} =2.5Ω, L=150μH	T _{vj} =25℃		635		μJ
关断能量 Turn-off switching energy	E _{off}		T _{vj} =175℃		815		
			T _{vj} =25℃		90		
			T _{vj} =175℃		100		
开通延迟时间 Turn-on delay time	t _{d on}	V _{DS} =800V, V _{GS} =-5/18V I _D =40A, R _{G ext} =2.5Ω, T _{vj} =25℃, L=150μH Timing relative to V _{DS}			16		ns
上升时间 Rise time	t _r				22		
关断延迟时间 Turn-off delay time	t _{d off}				20		
下降时间 Fall time	t _f				10		
栅极内阻 Internal gate resistance	R _{G int}	f=1MHz, V _{AC} =25mV			1.6		Ω
栅源电荷 Gate to source charge	Q _{GS}	V _{DS} =800V, V _{GS} =-5/18V I _D =40A			47		nC
栅漏电荷 Gate to drain charge	Q _{GD}				41		
栅极总电荷 Total gate charge	Q _G				132		

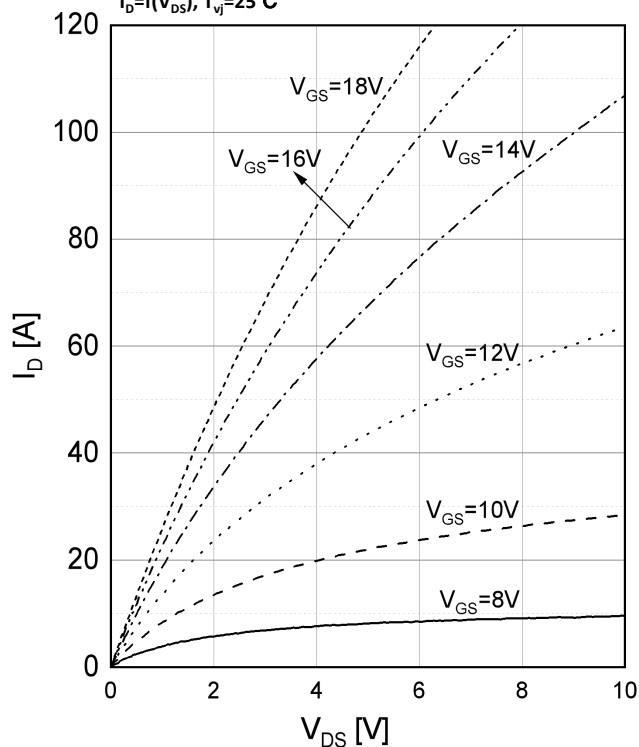
体二极管特性 Body Diode Characteristics (T_{vj}=25°C unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition		数值 Value			单位 Unit
				Min.	Typ.	Max.	
二极管正向电压 Diode forward voltage	V _{SD}	V _{GS} =-5V, I _S =20A	T _{vj} =25°C		4.4		V
			T _{vj} =175°C		3.8		
二极管连续正向电流 Continuous diode forward current	I _S	V _{GS} =-5V, T _C =25°C				79	A
二极管脉冲电流 Diode pulse current	I _{S pulse}	V _{GS} =-5V, Pulse width t _p limited by T _{vj max}				246	A
反向恢复时间 Reverse recovery time	t _{rr}	V _{GS} =-5V I _S =40A R _{G ext} =2.5Ω T _{vj} =25°C V _R =800V			59		ns
反向恢复电荷 Reverse recovery charge	Q _{rr}				3		uC
反向恢复峰值电流 Peak reverse recovery current	I _{RRM}				22		A

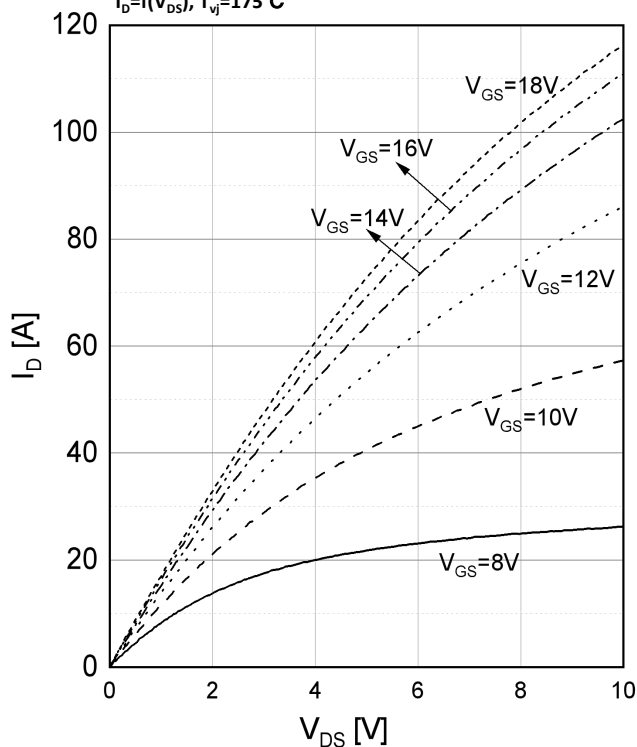
热特性 Thermal Characteristics

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
结-壳热阻 Thermal resistance: junction to case	R _{th JC}			0.36		K/W

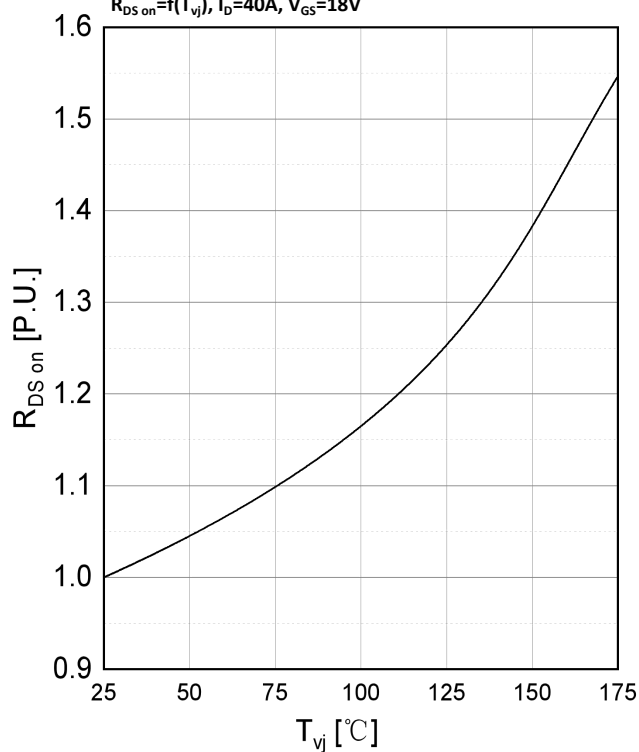
输出特性
Output Characteristics
 $I_D = f(V_{DS}), T_{vj} = 25^\circ\text{C}$



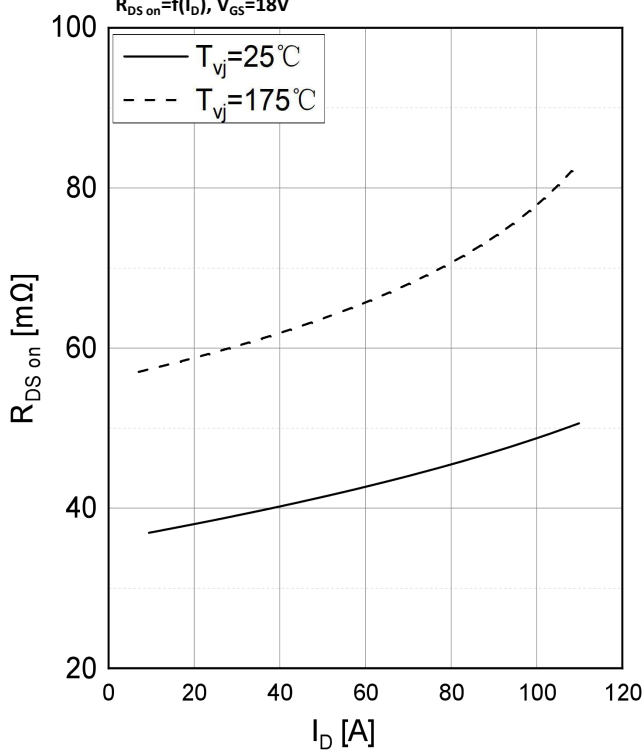
输出特性
Output Characteristics
 $I_D = f(V_{DS}), T_{vj} = 175^\circ\text{C}$



标准化导通电阻
Normalized On-Resistance
 $R_{DS\text{ on}} = f(T_{vj}), I_D = 40\text{A}, V_{GS} = 18\text{V}$



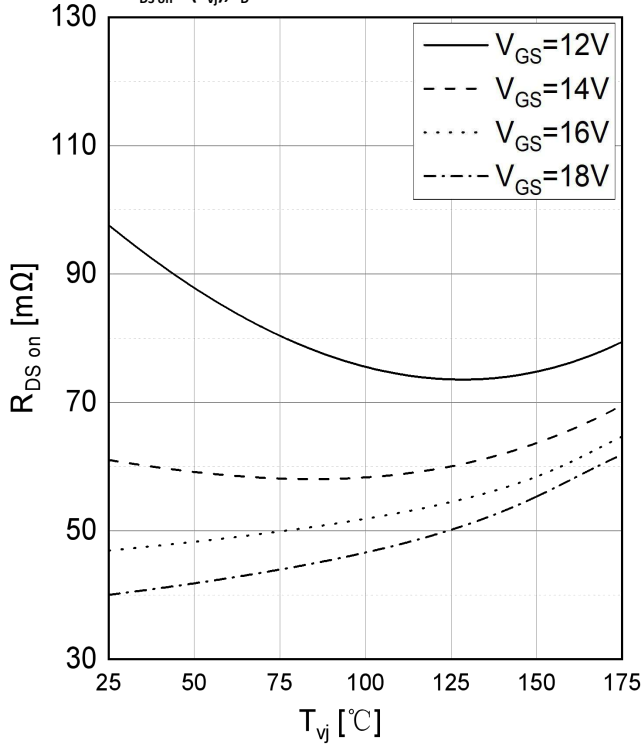
导通电阻
On-Resistance
 $R_{DS\text{ on}} = f(I_D), V_{GS} = 18\text{V}$



导通电阻

On-Resistance

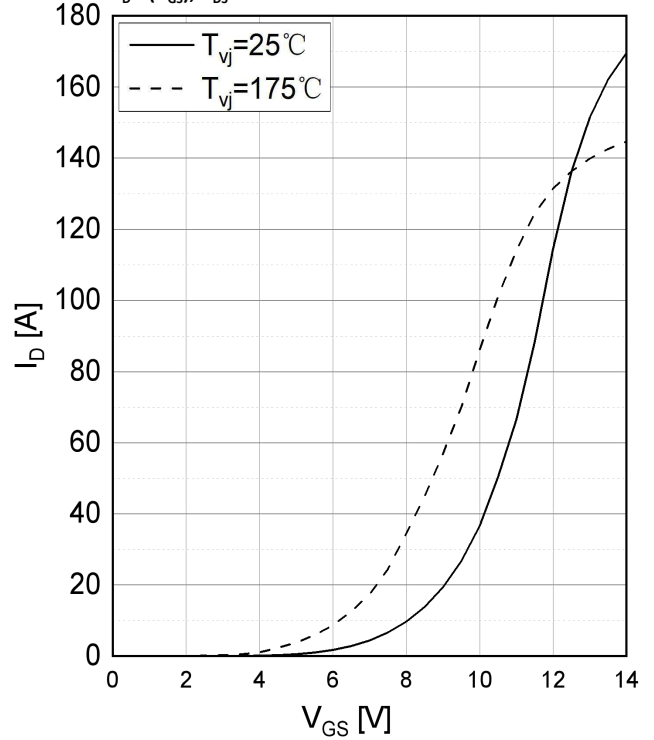
$$R_{DS\ on}=f(T_{vj}), I_D=40A$$



转移特性

Transfer Characteristics

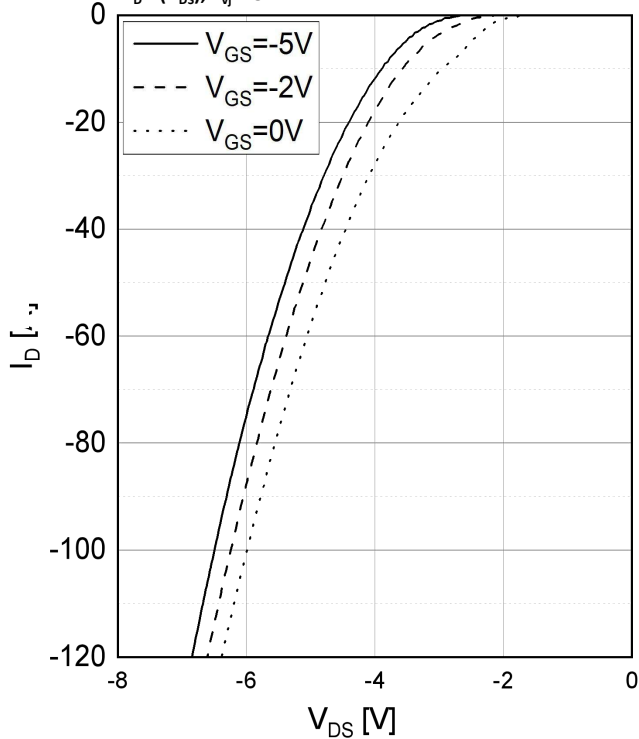
$$I_D=f(V_{GS}), V_{DS}=20V$$



体二极管特性

Body Diode Characteristics

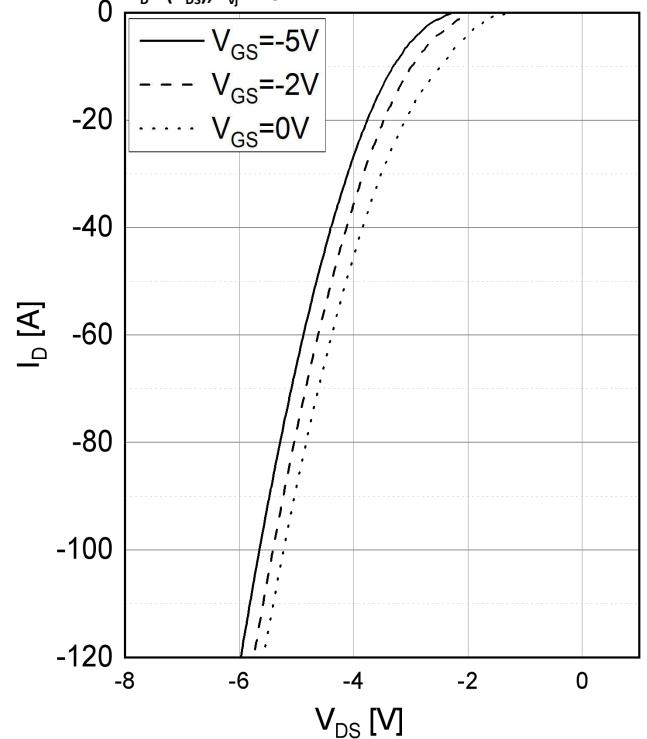
$$I_D=f(V_{DS}), T_{vj}=25^{\circ}C$$



体二极管特性

Body Diode Characteristics

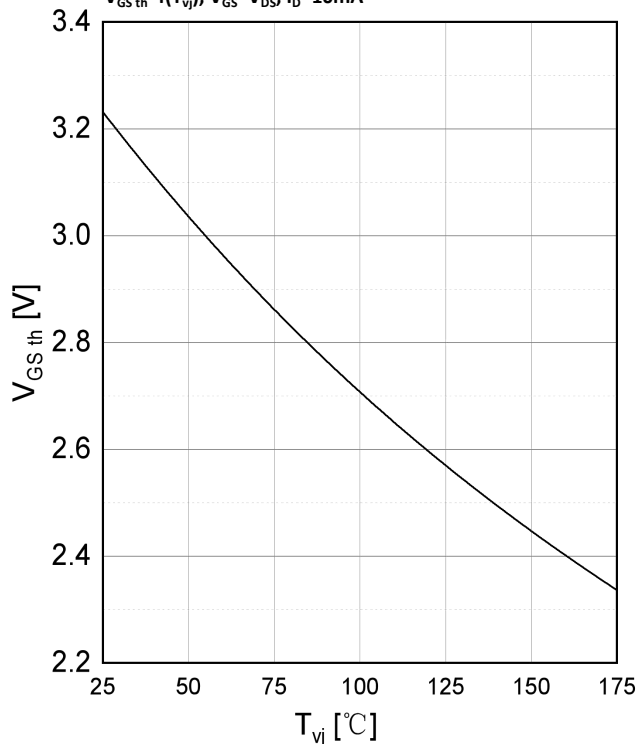
$$I_D=f(V_{DS}), T_{vj}=175^{\circ}C$$



阈值电压

Threshold Voltage

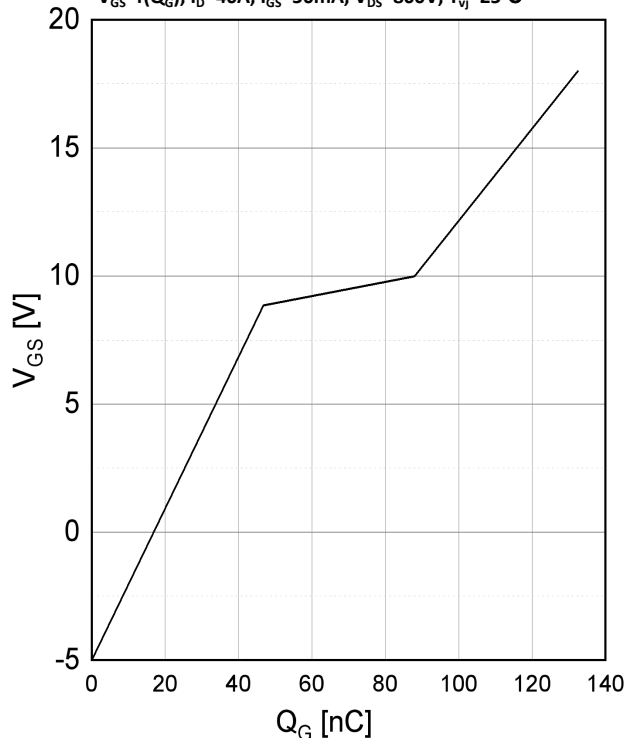
$V_{GS\ th}=f(T_{vj})$, $V_{GS}=V_{DS}$, $I_D=10mA$



栅极电荷特性

Gate Charge Characteristics

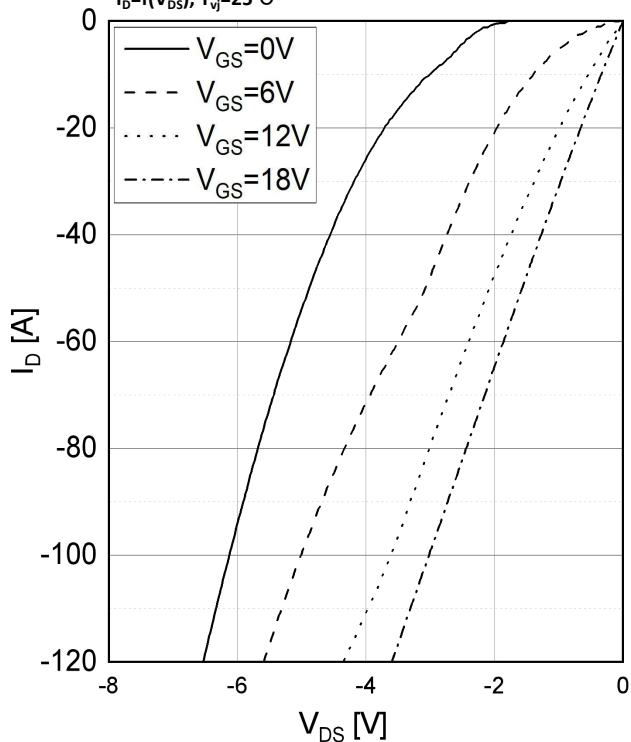
$V_{GS}=f(Q_G)$, $I_D=40A$, $I_{GS}=50mA$, $V_{DS}=800V$, $T_{vj}=25^\circ C$



第三象限特性

3rd Quadrant Characteristics

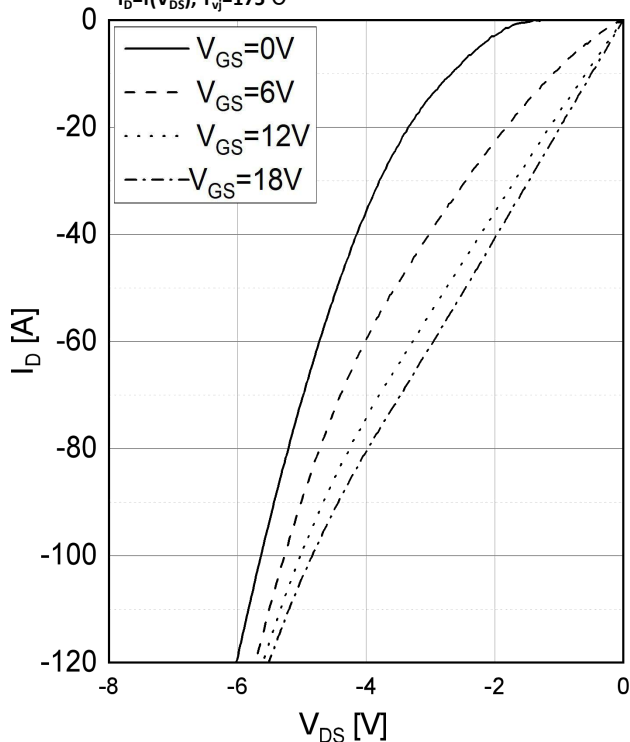
$I_D=f(V_{DS})$, $T_{vj}=25^\circ C$



第三象限特性

3rd Quadrant Characteristics

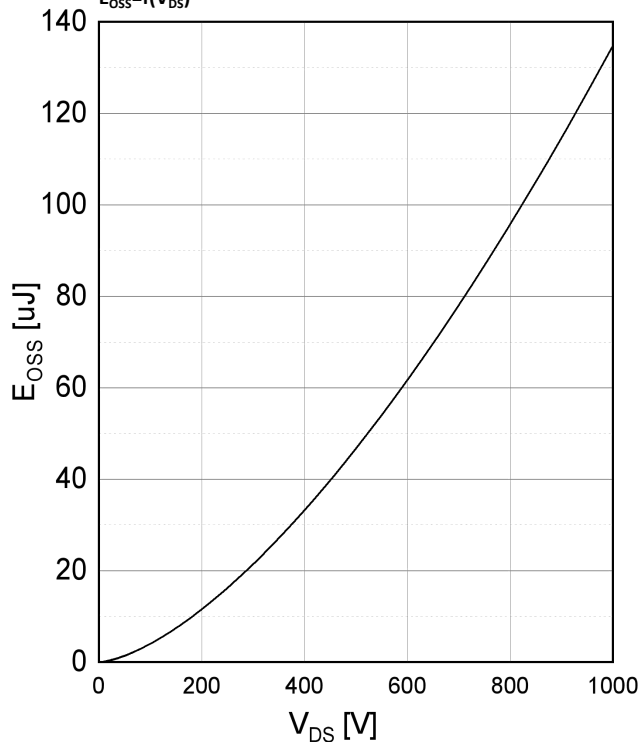
$I_D=f(V_{DS})$, $T_{vj}=175^\circ C$



输出电容存储能量

Output Capacitor Stored Energy

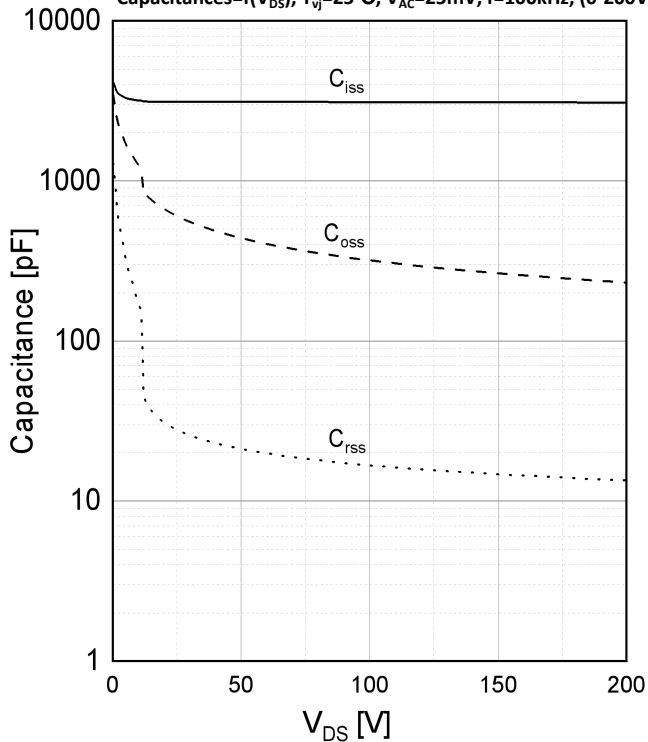
$$E_{OSS}=f(V_{DS})$$



电容

Capacitances

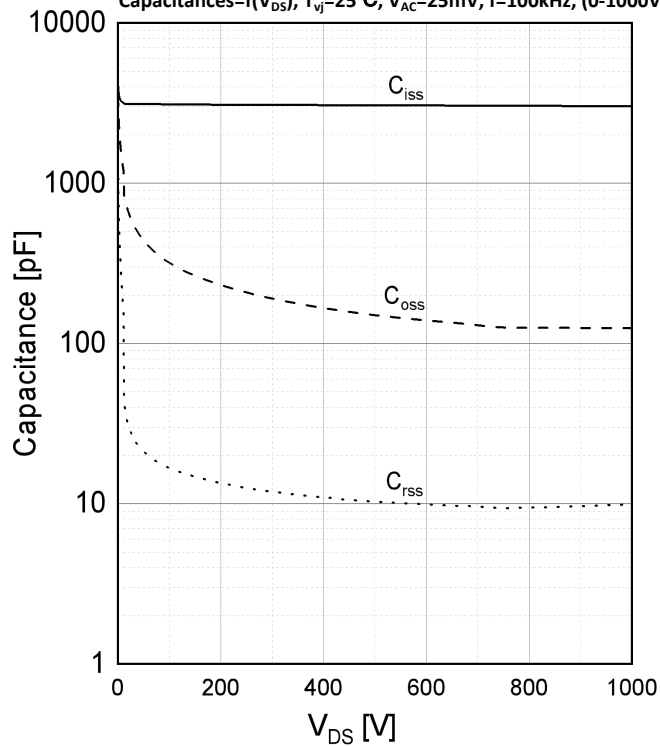
$$\text{Capacitances}=f(V_{DS}), T_{vj}=25^{\circ}\text{C}, V_{AC}=25\text{mV}, f=100\text{kHz}, (0-200\text{V})$$



电容

Capacitances

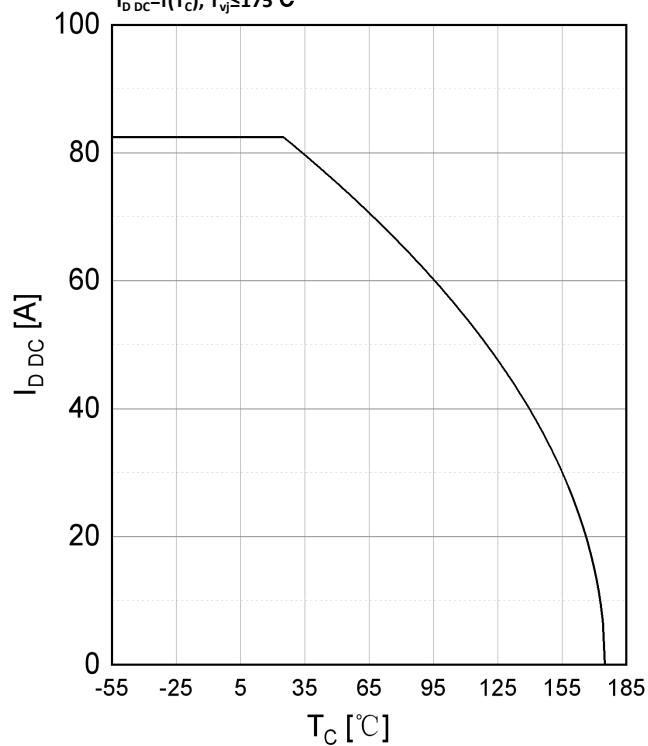
$$\text{Capacitances}=f(V_{DS}), T_{vj}=25^{\circ}\text{C}, V_{AC}=25\text{mV}, f=100\text{kHz}, (0-1000\text{V})$$



连续漏极电流衰减

Continuous Drain Current Derating

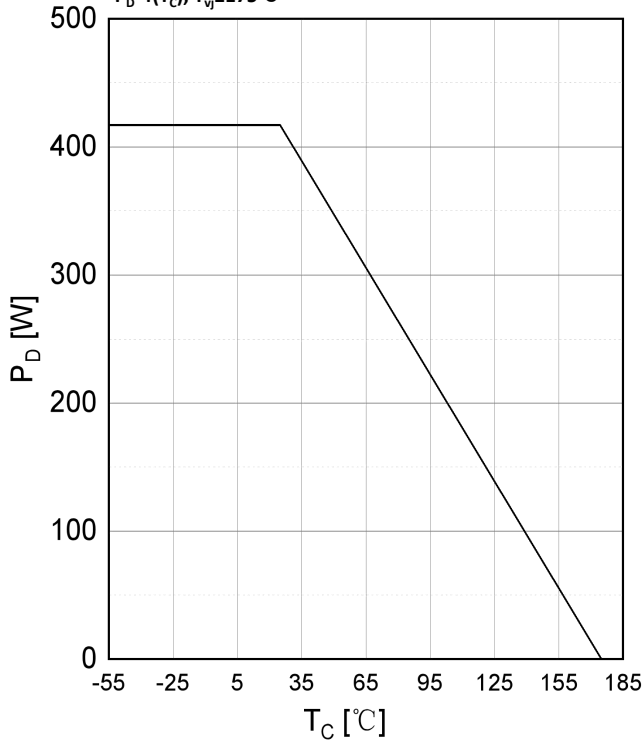
$$I_{D\ DC}=f(T_c), T_{vj}\leq 175^{\circ}\text{C}$$



最大功耗衰减

Maximum Power Dissipation Derating

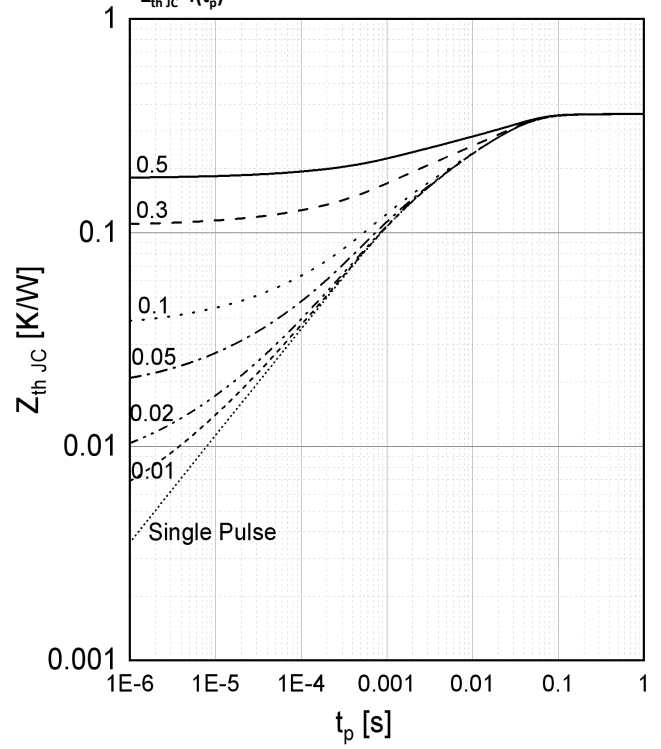
$$P_D = f(T_C), T_{vj} \leq 175^\circ\text{C}$$



瞬态热阻 (结-壳)

Transient Thermal Impedance (Junction-Case)

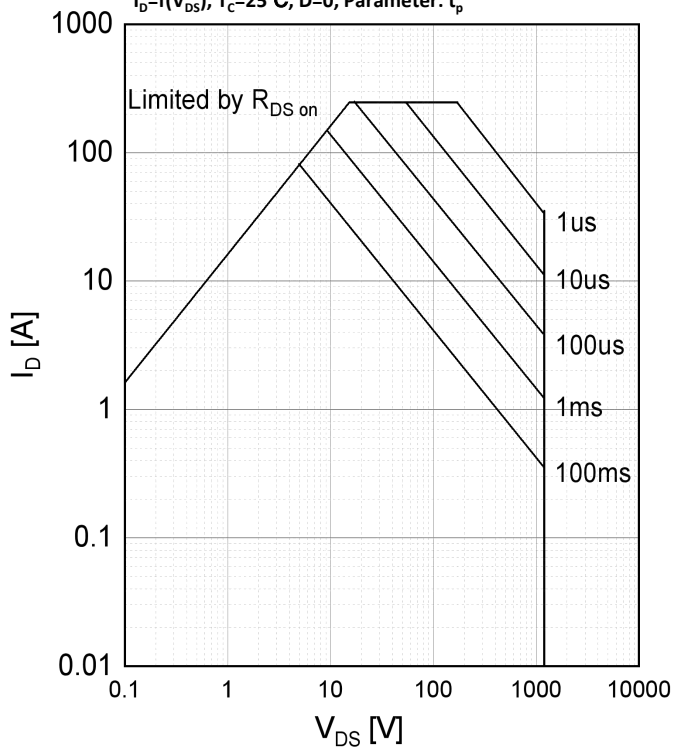
$$Z_{th JC} = f(t_p)$$



安全工作区

Safe Operating Area

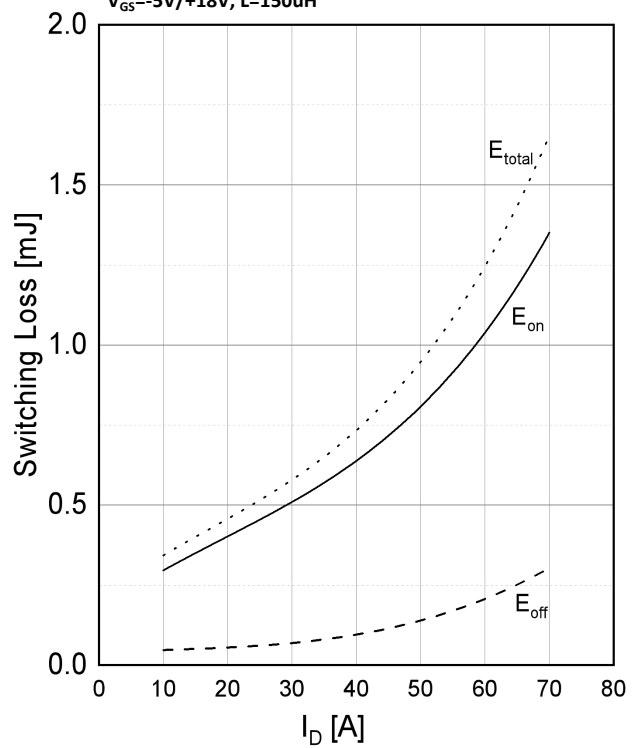
$$I_D = f(V_{DS}), T_C = 25^\circ\text{C}, D=0, \text{Parameter: } t_p$$



开关能量

Switching Energy

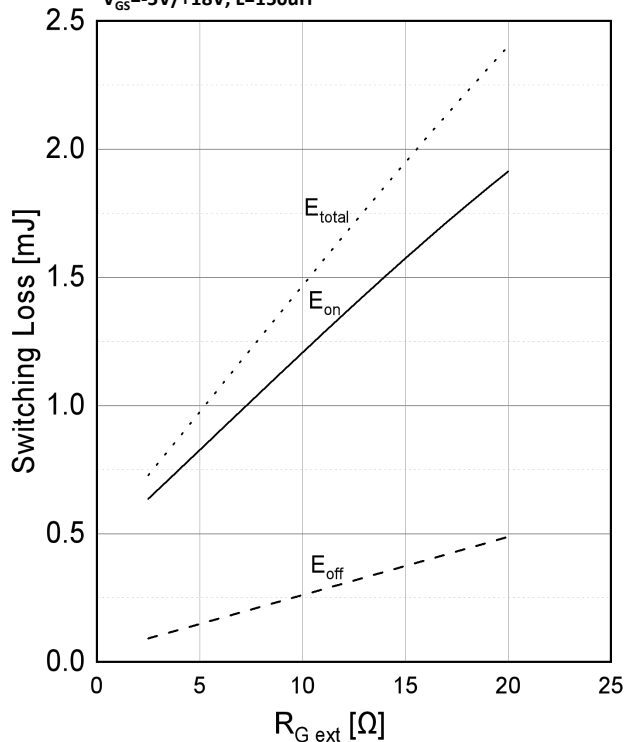
$$\text{Switching Loss} = f(I_D), T_{vj} = 25^\circ\text{C}, V_{DS} = 800\text{V}, R_{G ext} = 2.5\Omega, V_{GS} = -5\text{V}/+18\text{V}, L = 150\mu\text{H}$$



开关能量

Switching Energy

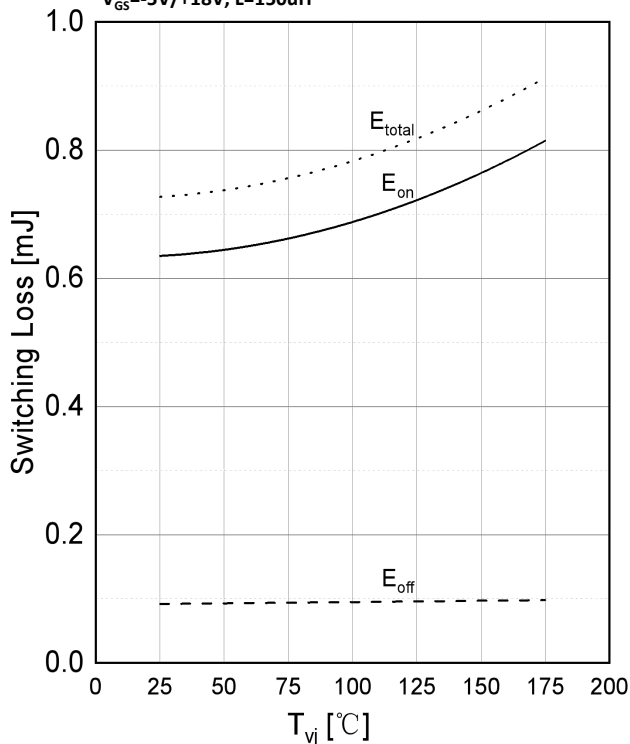
Switching Loss=f($R_{G\ ext}$), $T_{vj}=25^{\circ}C$, $V_{DS}=800V$, $I_D=40A$,
 $V_{GS}=-5V/+18V$, $L=150\mu H$



开关能量

Switching Energy

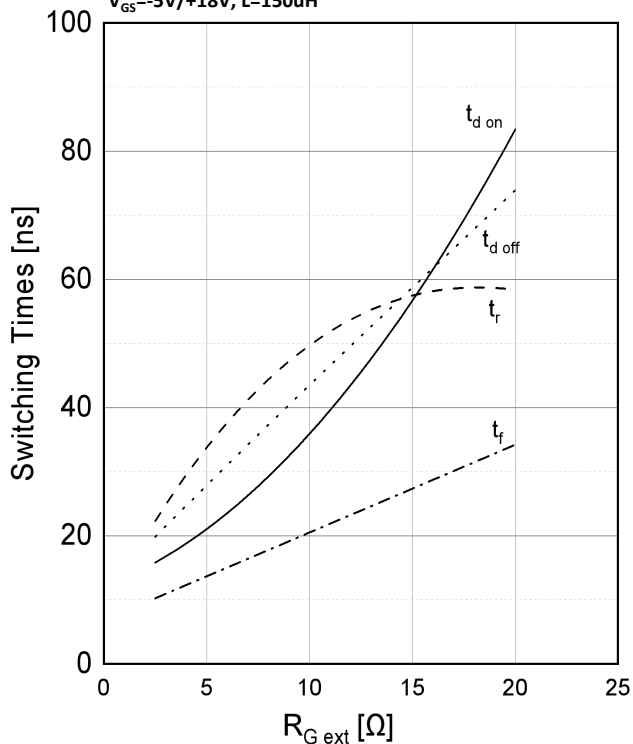
Switching Loss=f(T_{vj}), $V_{DS}=800V$, $I_D=40A$, $R_{G\ ext}=2.5\Omega$,
 $V_{GS}=-5V/+18V$, $L=150\mu H$



开关时间

Switching Times

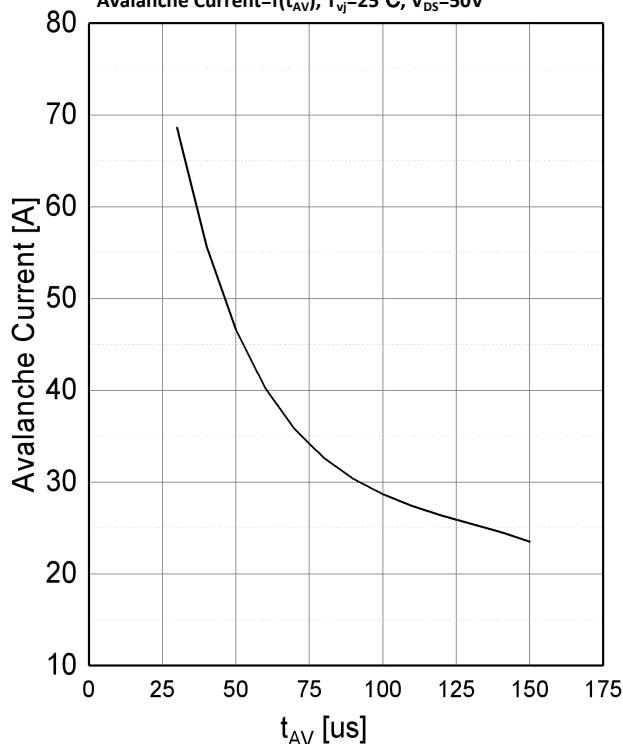
Switching Times=f($R_{G\ ext}$), $T_{vj}=25^{\circ}C$, $V_{DS}=800V$, $I_D=40A$,
 $V_{GS}=-5V/+18V$, $L=150\mu H$



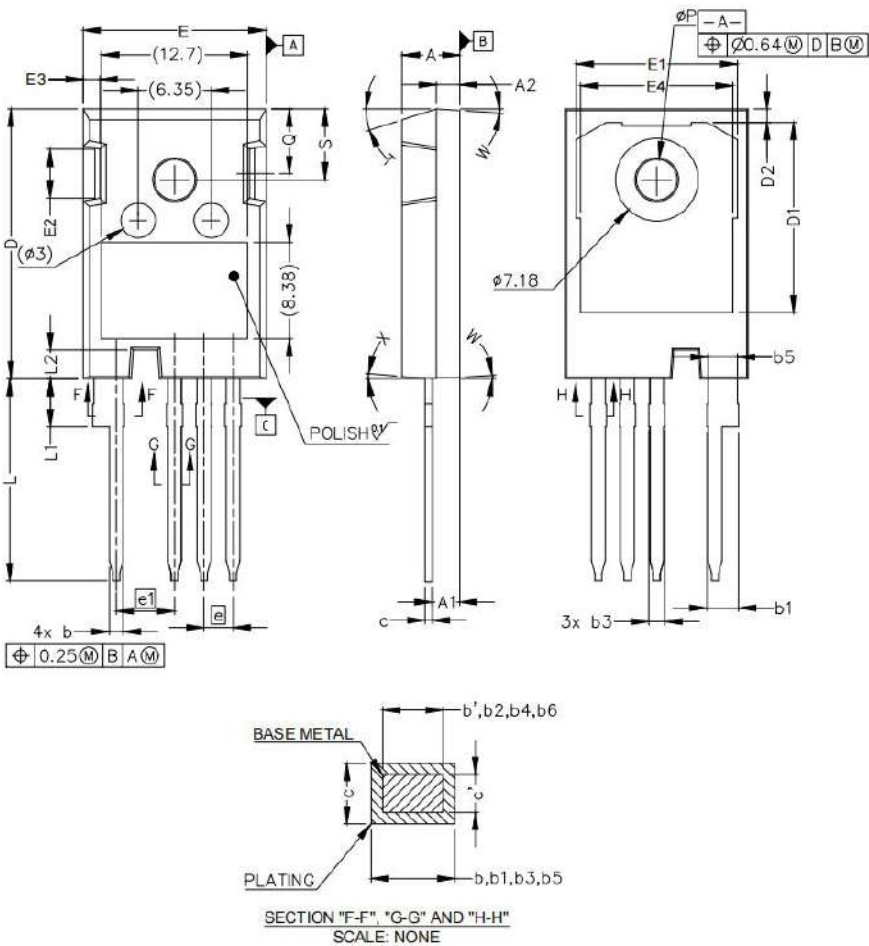
单次雪崩安全工作区

Single Avalanche Safe Operating Area

Avalanche Current=f(t_{AV}), $T_{vj}=25^{\circ}C$, $V_{DS}=50V$



外形尺寸 Outline Drawing



SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5 ° REF.	
X	4° REF.	

日期 Date	描述 Description
2025-4-21	正式版

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4. 产品在使用时，严禁触碰，断电后确认无残余电荷且产品已完全冷却后，才可以在有静电防护措施下触碰产品；

When the product is in use, it is strictly forbidden to touch the product. After power off, it is confirmed that there is no residual charge and the product has been completely cooled, and it can only be touched under electrostatic protection measures;

5. 购买产品时请认准我司商标，如有疑问请与本司联系。

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