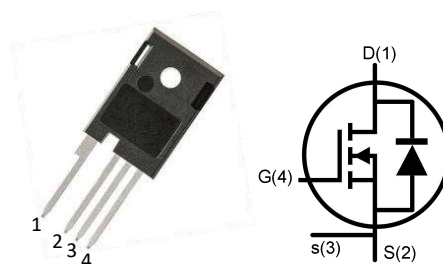


HCM13S12T4K3A

1200V 13mΩ 碳化硅功率MOSFET, TO-247-4L
1200V 13mΩ Silicon Carbide Power MOSFET, TO-247-4L

特点 Features

- 第三代SiC MOSFET技术
3rd Generation SiC MOSFET Technology
- 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
- 无卤素添加，符合RoHS标准
Halogen Free, RoHS Compliant



应用 Applications

- 汽车传动系统
Automotive Drive-train
- 电机驱动器
Motor Drives
- 固态电路制动器
Solid State Circuit Braker
- 谐振拓扑
Resonant Topologies

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	$V_{GS}=18V, T_c=25^{\circ}\text{C}$	155	A
		$V_{GS}=18V, T_c=100^{\circ}\text{C}$	110	
漏极脉冲电流 Pulsed drain current	$I_{D\ pulse}$	Pulse width t_p limited by $T_{vj\ max}$	310	A
耗散功率 Power dissipation	P_D	$T_c=25^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	555	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 =20mA	T _{vj} =25℃	2.0	2.9	4.0	V
			T _{vj} =175℃		2.1		
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 =70A	T _{vj} =25℃		13	17	mΩ
			T _{vj} =175℃		23		
跨导 Transconductance	g _{fs}	V _{DS} =20V, I _D =70A	T _{vj} =25℃		48		S
			T _{vj} =175℃		47		
输入电容 Input capacitance	C _{iss}	V _{GS} =0V V _{DS} =1000V f=100kHz V _{AC} =25mV			3852		pF
输出电容 Output capacitance	C _{oss}				240		
反向传输电容 Reverse transfer capacitance	C _{rss}				27		
输出电容存储能量 C _{oss} stored energy	E _{oss}				232		μJ
开通能量 Turn-on switching energy	E _{on}	V _{DS} =800V, V _{GS} =-5/18V I _D =70A, R _{G ext} =2.5Ω, L=150μH	T _{vj} =25℃		2483		μJ
关断能量 Turn-off switching energy	E _{off}		T _{vj} =175℃		2510		
			T _{vj} =25℃		1669		
			T _{vj} =175℃		1806		
开通延迟时间 Turn-on delay time	t _{d on}	V _{DS} =800V, V _{GS} =-5/18V I _D =70A, R _{G ext} =2.5Ω, T _{vj} =25℃, L=150μH Timing relative to V _{DS}			15		ns
上升时间 Rise time	t _r				70		
关断延迟时间 Turn-off delay time	t _{d off}				82		
下降时间 Fall time	t _f				27		
栅极内阻 Internal gate resistance	R _{G int}	f=1MHz, V _{AC} =25mV			5.2		Ω
栅源电荷 Gate to source charge	Q _{GS}	V _{DS} =800V, V _{GS} =-5/18V I _D =70A			46		nC
栅漏电荷 Gate to drain charge	Q _{GD}				100		
栅极总电荷 Total gate charge	Q _G				216		

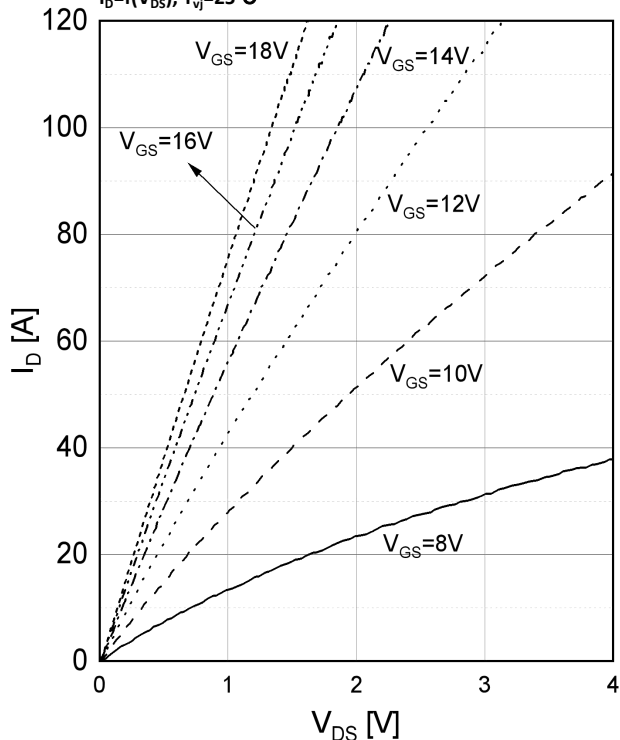
体二极管特性 Body Diode Characteristics ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
二极管正向电压 Diode forward voltage	V_{SD}	$V_{GS}=-5\text{V}, I_S=37.5\text{A}$		4.6		V
				4.0		
二极管连续正向电流 Continuous diode forward current	I_S	$V_{GS}=-5\text{V}, T_C=25^{\circ}\text{C}$			104	A
二极管脉冲电流 Diode pulse current	$I_{S\text{ pulse}}$	$V_{GS}=-5\text{V}$, Pulse width t_p limited by $T_{vj\text{ max}}$			310	A
反向恢复时间 Reverse recovery time	t_{rr}	$V_{GS}=-5\text{V}$ $I_S=70\text{A}$ $R_{G\text{ ext}}=2.5\Omega$ $T_{vj}=175^{\circ}\text{C}$ $V_R=800\text{V}$		75		ns
反向恢复电荷 Reverse recovery charge	Q_{rr}			2080		nC
反向恢复峰值电流 Peak reverse recovery current	I_{RRM}			45		A

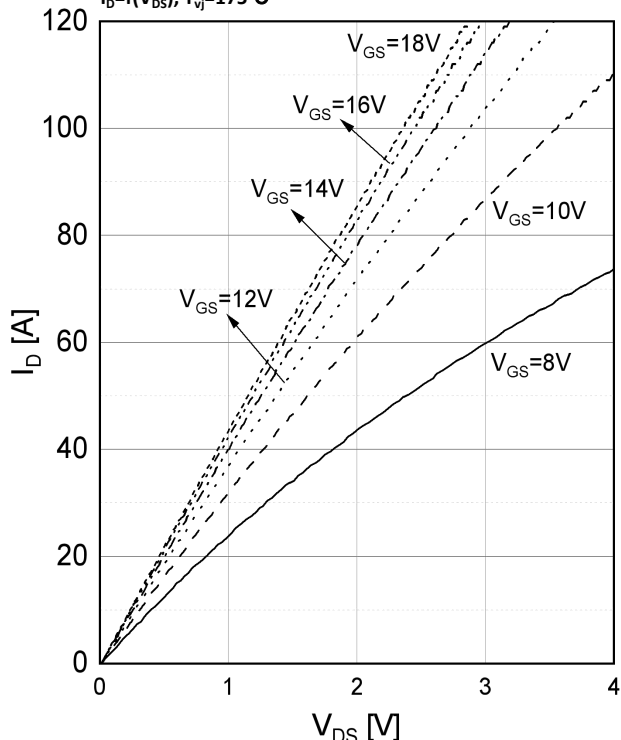
热特性 Thermal Characteristics

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	$R_{th\text{ JC}}$			0.27		K/W

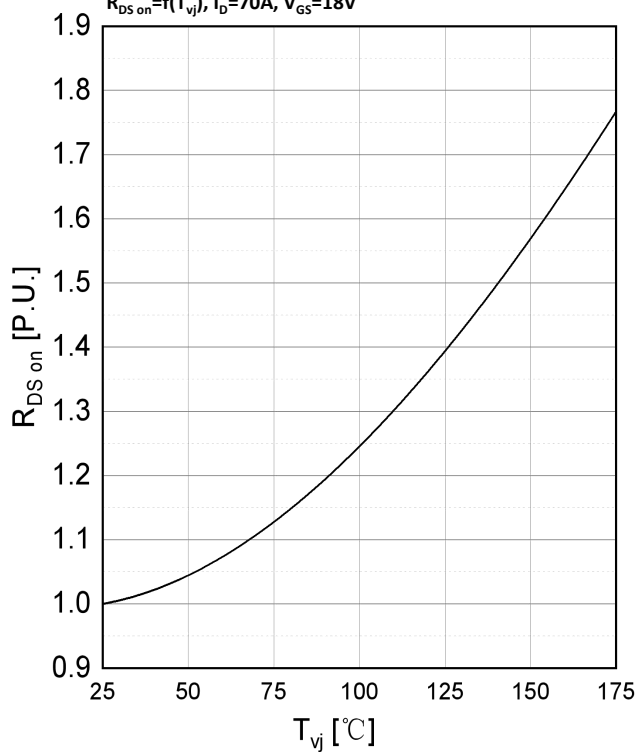
输出特性
Output Characteristics
 $I_D = f(V_{DS}), T_{vj} = 25^\circ\text{C}$



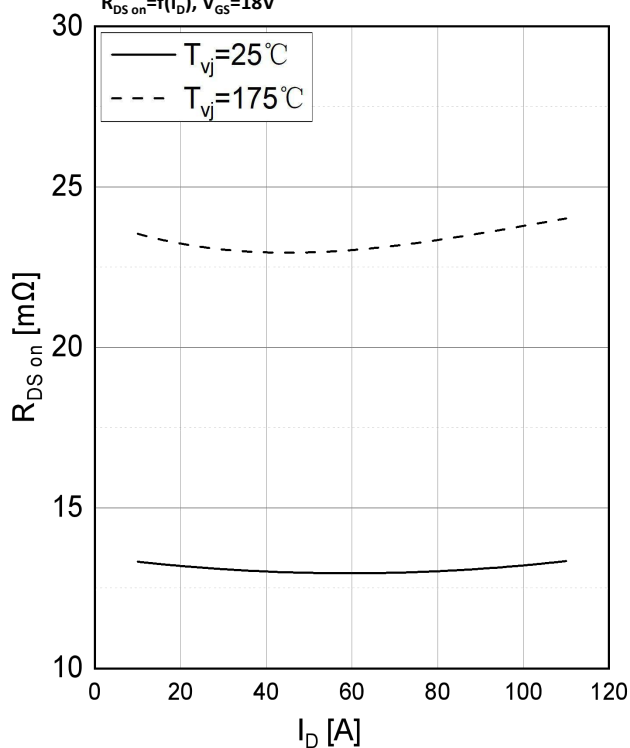
输出特性
Output Characteristics
 $I_D = f(V_{DS}), T_{vj} = 175^\circ\text{C}$



标准化导通电阻
Normalized On-Resistance
 $R_{DS\ on} = f(T_{vj}), I_D = 70A, V_{GS} = 18V$



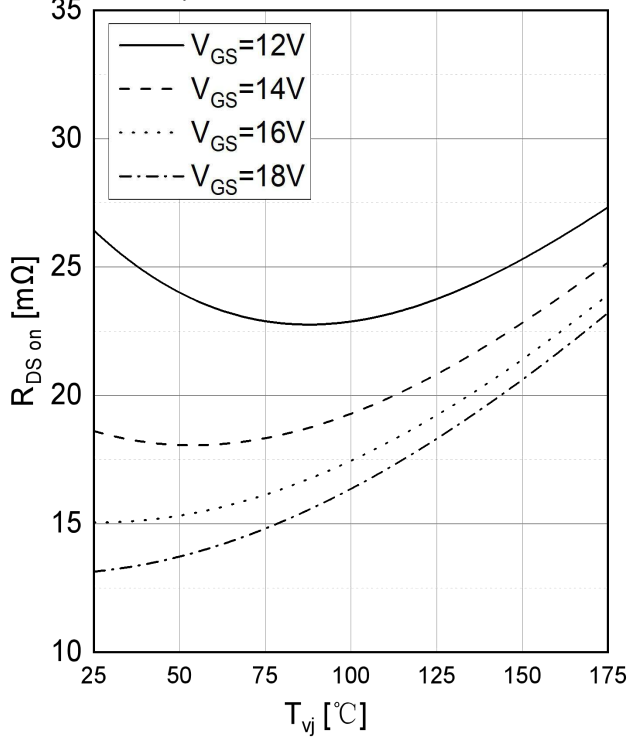
导通电阻
On-Resistance
 $R_{DS\ on} = f(I_D), V_{GS} = 18V$



导通电阻

On-Resistance

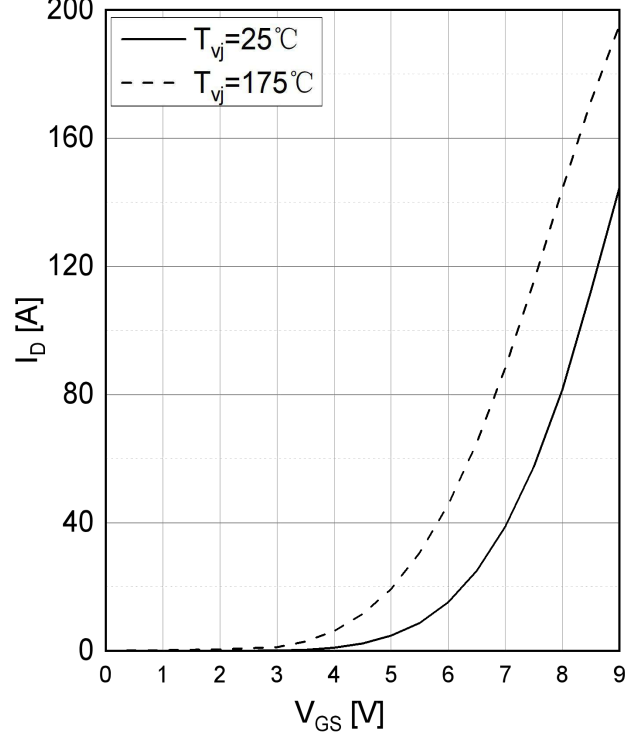
$$R_{DS\ on}=f(T_{vj}), I_D=70A$$



转移特性

Transfer Characteristics

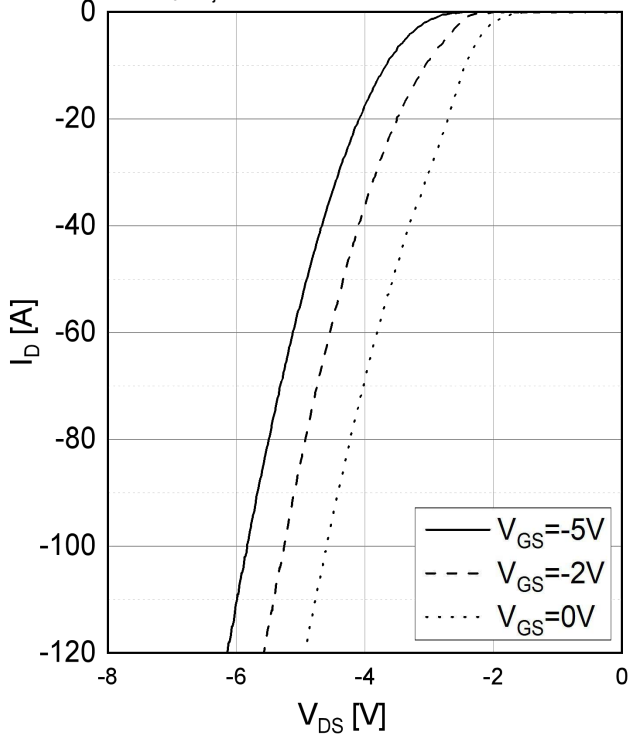
$$I_D=f(V_{GS}), V_{DS}=20V$$



体二极管特性

Body Diode Characteristics

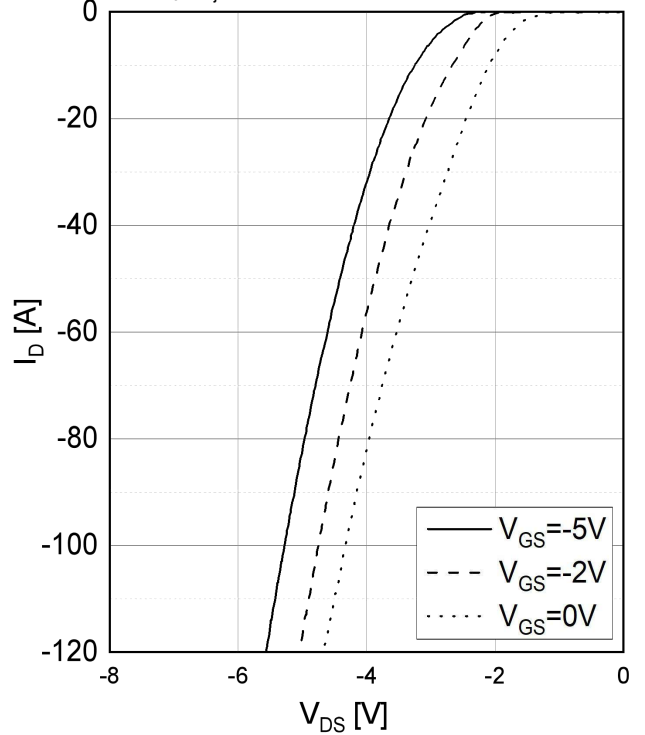
$$I_D=f(V_{DS}), T_{vj}=25^{\circ}C$$



体二极管特性

Body Diode Characteristics

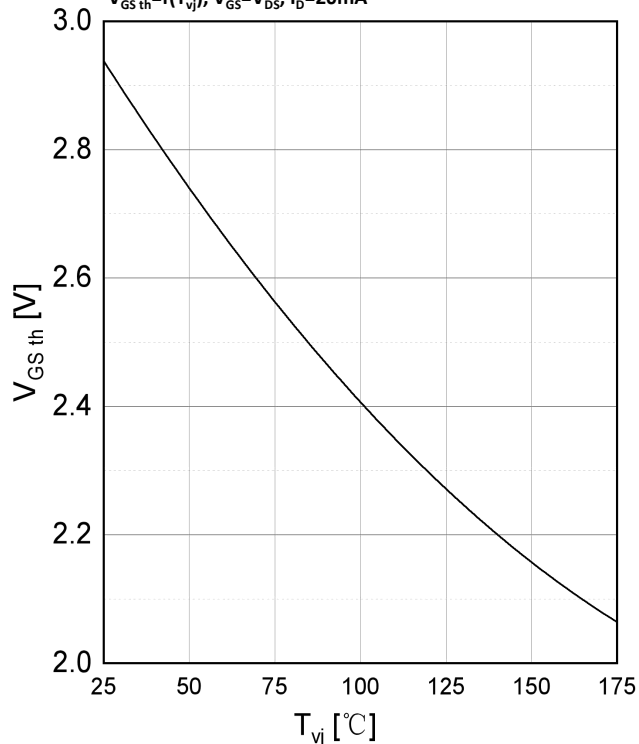
$$I_D=f(V_{DS}), T_{vj}=175^{\circ}C$$



阈值电压

Threshold Voltage

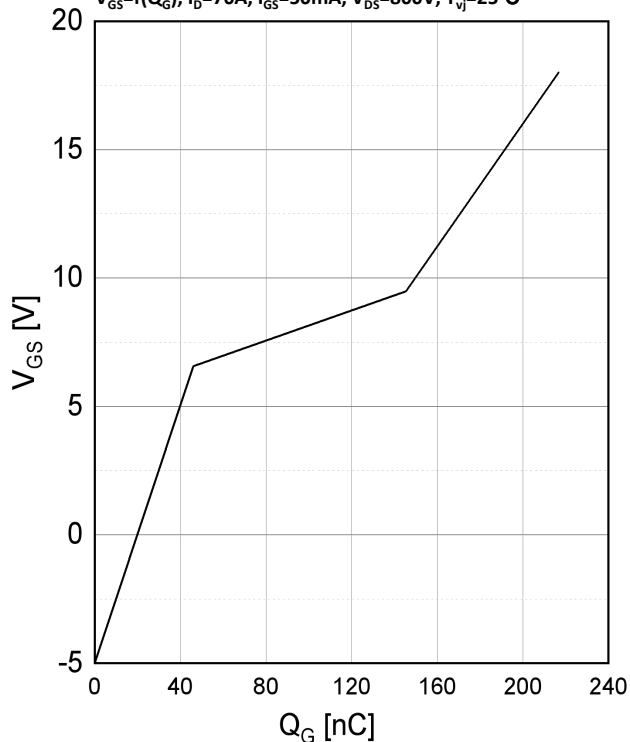
$V_{GS\ th}=f(T_{vj})$, $V_{GS}=V_{DS}$, $I_D=20mA$



栅极电荷特性

Gate Charge Characteristics

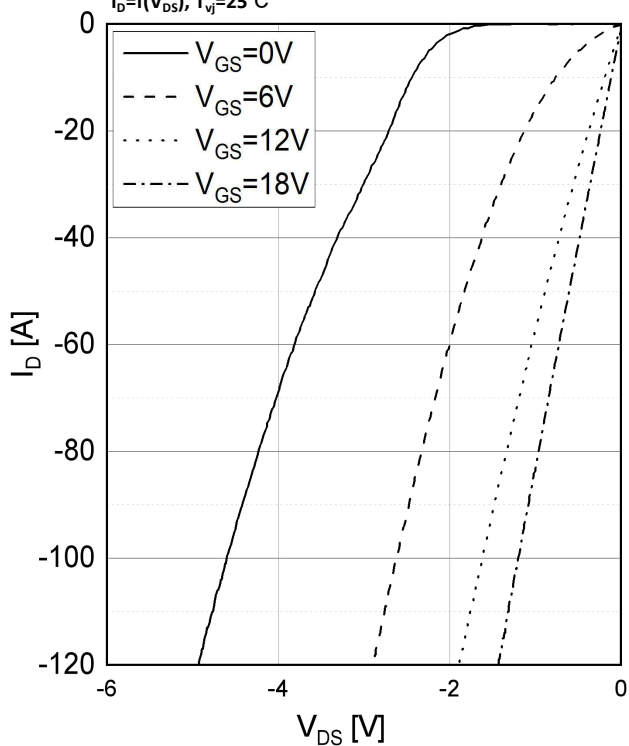
$V_{GS}=f(Q_G)$, $I_D=70A$, $I_{GS}=50mA$, $V_{DS}=800V$, $T_{vj}=25^\circ C$



第三象限特性

3rd Quadrant Characteristics

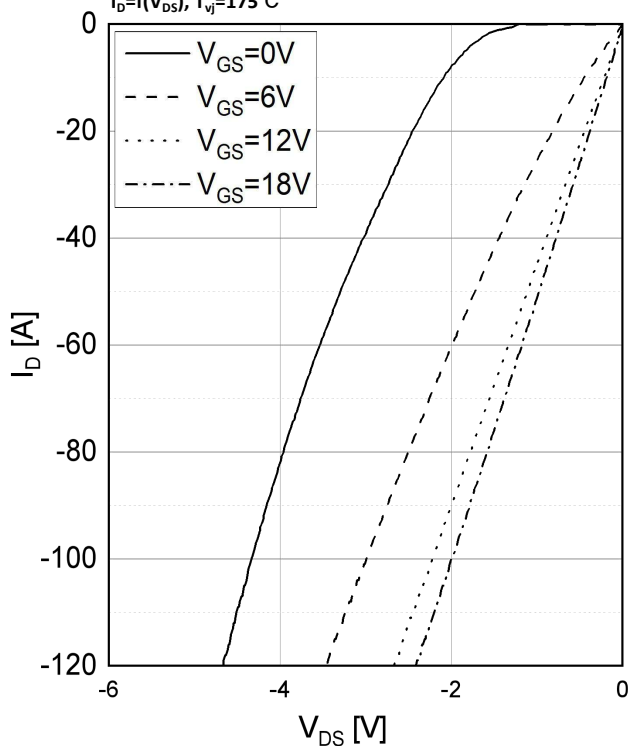
$I_D=f(V_{DS})$, $T_{vj}=25^\circ C$



第三象限特性

3rd Quadrant Characteristics

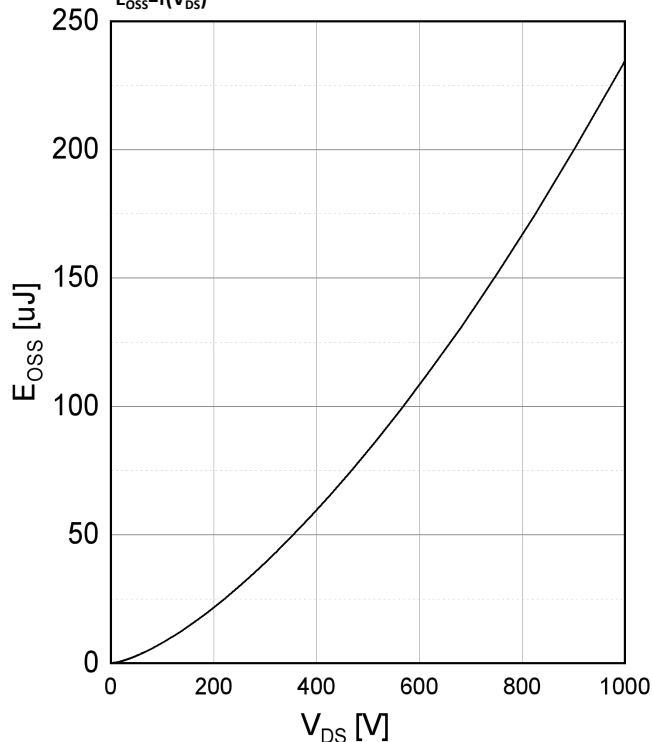
$I_D=f(V_{DS})$, $T_{vj}=175^\circ C$



输出电容存储能量

Output Capacitor Stored Energy

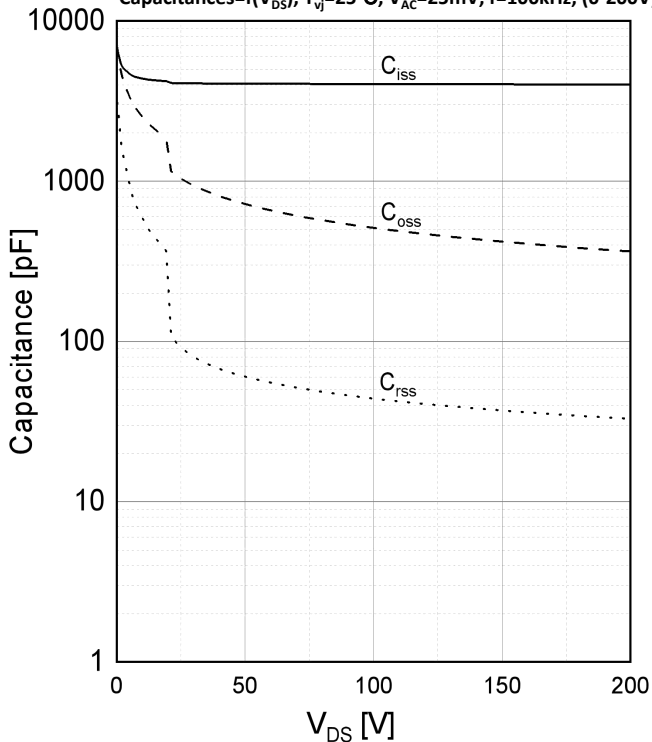
$$E_{OSS}=f(V_{DS})$$



电容

Capacitances

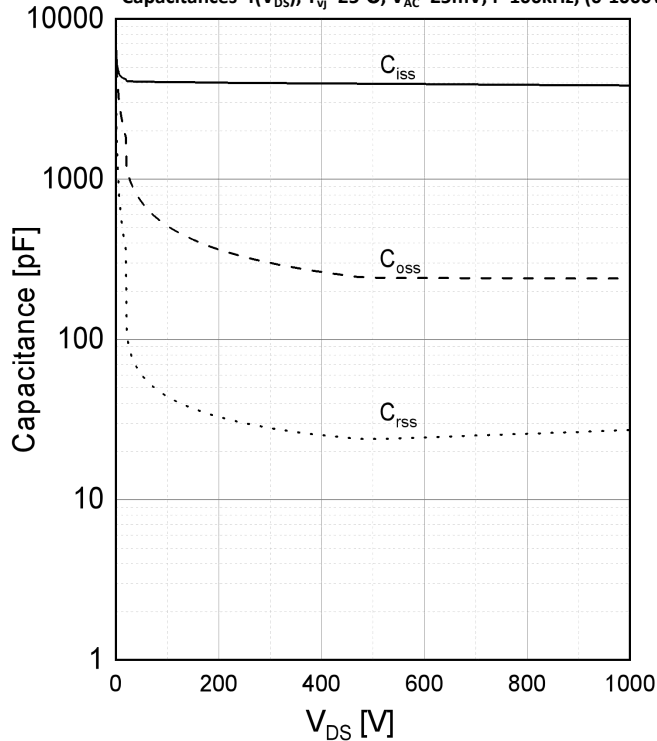
$$\text{Capacitances}=f(V_{DS}), T_{vj}=25^{\circ}\text{C}, V_{AC}=25\text{mV}, f=100\text{kHz}, (0-200\text{V})$$



电容

Capacitances

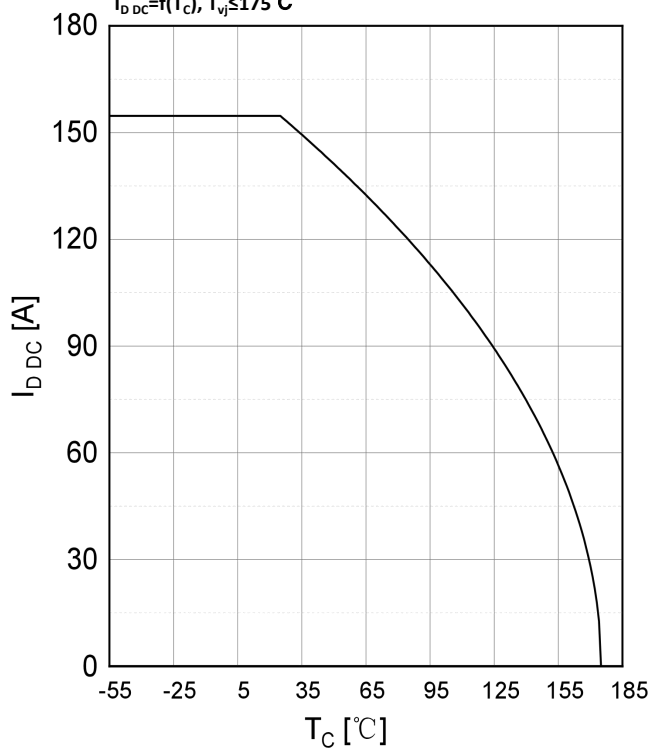
$$\text{Capacitances}=f(V_{DS}), T_{vj}=25^{\circ}\text{C}, V_{AC}=25\text{mV}, f=100\text{kHz}, (0-1000\text{V})$$



连续漏极电流衰减

Continuous Drain Current Derating

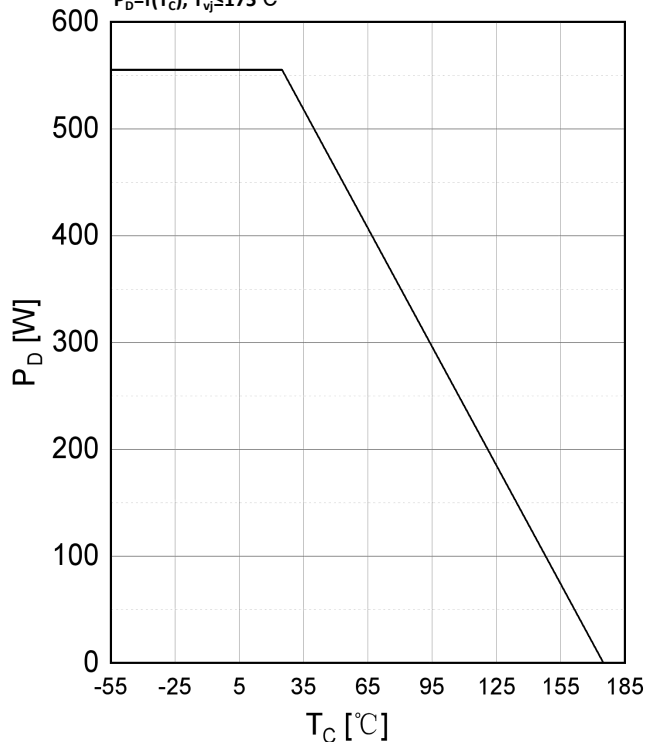
$$I_{D\ DC}=f(T_c), T_{vj}\leq 175^{\circ}\text{C}$$



最大功耗衰减

Maximum Power Dissipation Derating

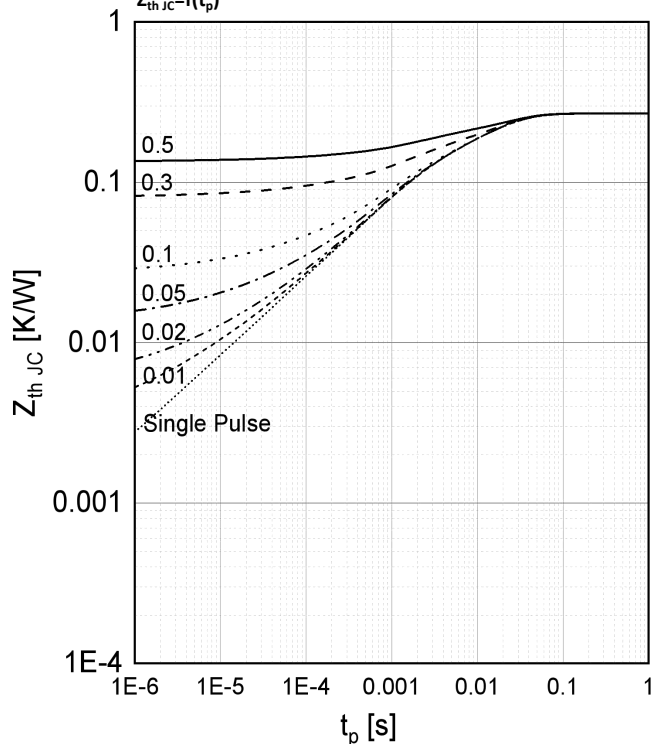
$$P_D = f(T_C), T_{vj} \leq 175^\circ\text{C}$$



瞬态热阻 (结-壳)

Transient Thermal Impedance (Junction-Case)

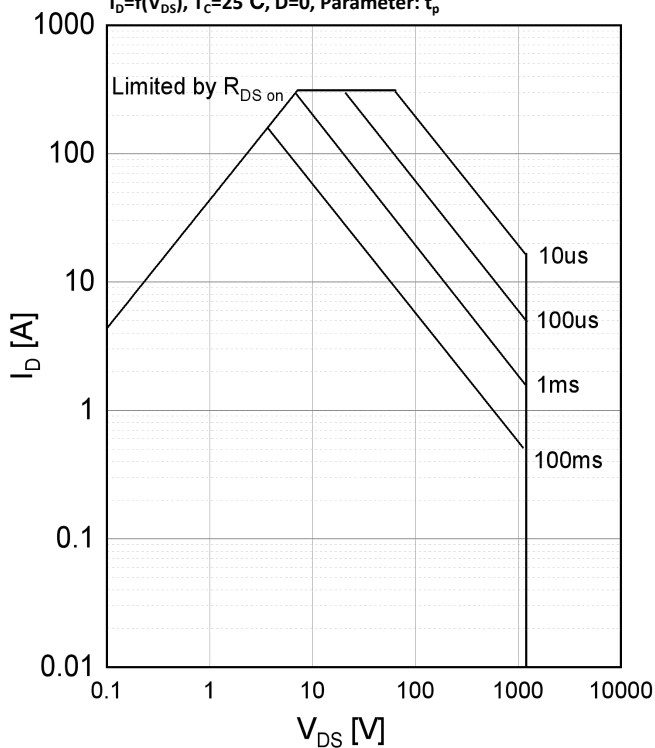
$$Z_{thJC} = f(t_p)$$



安全工作区

Safe Operating Area

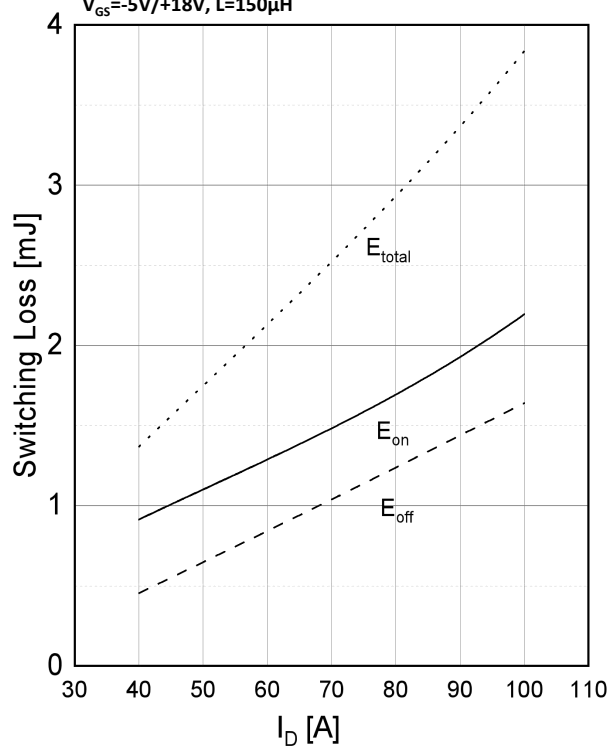
$$I_D = f(V_{DS}), T_C = 25^\circ\text{C}, D = 0, \text{Parameter: } t_p$$



开关能量

Switching Energy

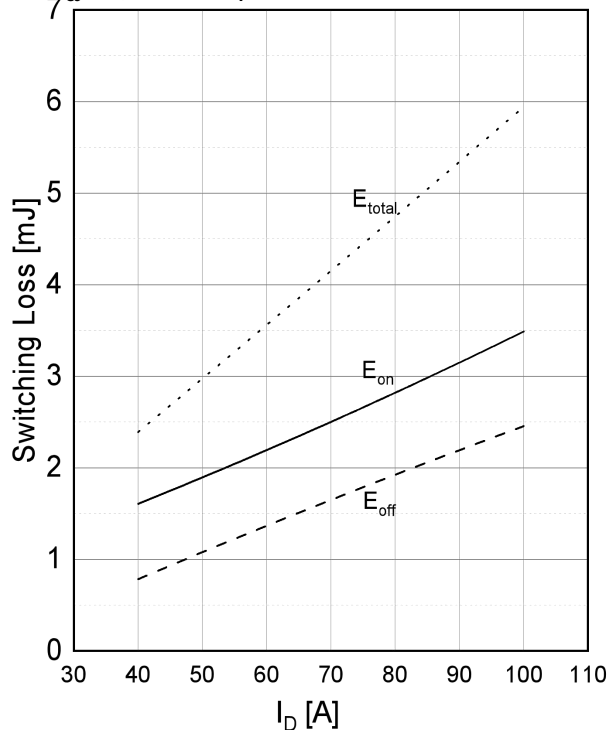
$$\text{Switching Loss} = f(I_D), T_{vj} = 25^\circ\text{C}, V_{DS} = 600\text{V}, R_{G\text{ext}} = 2.5\Omega, V_{GS} = -5\text{V}/+18\text{V}, L = 150\mu\text{H}$$



开关能量

Switching Energy

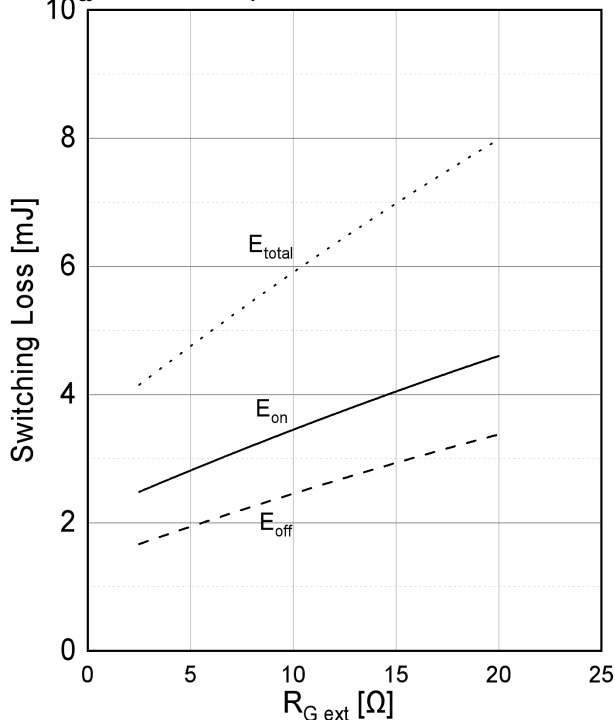
Switching Loss=f(I_D), $T_{vj}=25^\circ\text{C}$, $V_{DS}=800\text{V}$, $R_{G\text{ ext}}=2.5\Omega$,
 $V_{GS}=-5\text{V}/+18\text{V}$, $L=150\mu\text{H}$



开关能量

Switching Energy

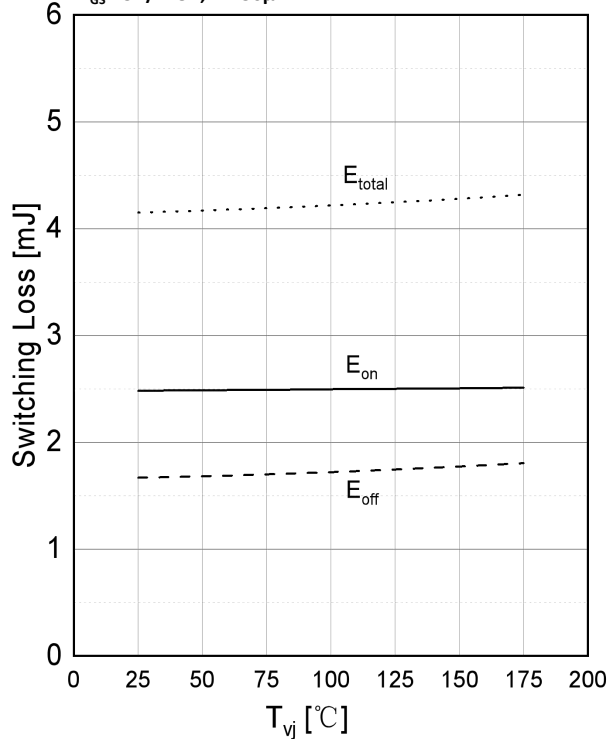
Switching Loss=f($R_{G\text{ ext}}$), $T_{vj}=25^\circ\text{C}$, $V_{DS}=800\text{V}$, $I_D=70\text{A}$,
 $V_{GS}=-5\text{V}/+18\text{V}$, $L=150\mu\text{H}$



开关能量

Switching Energy

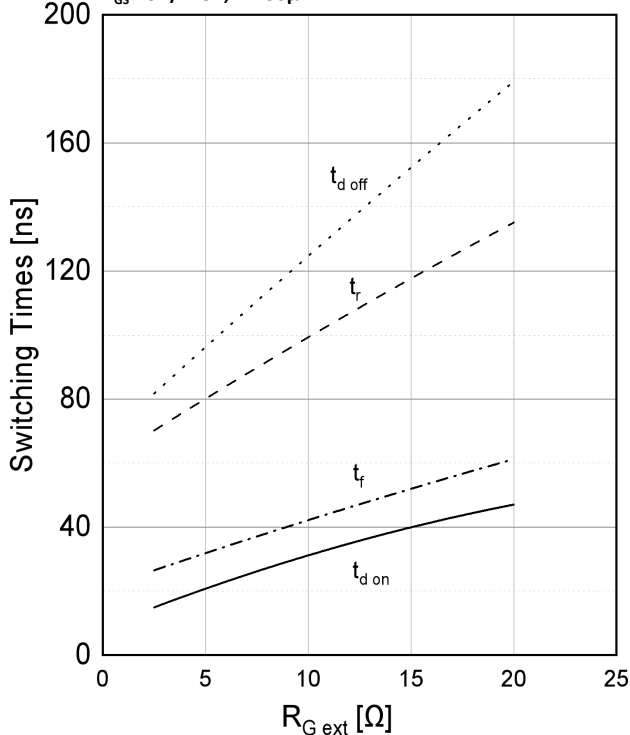
Switching Loss=f(T_{vj}), $V_{DS}=800\text{V}$, $I_D=70\text{A}$, $R_{G\text{ ext}}=2.5\Omega$,
 $V_{GS}=-5\text{V}/+18\text{V}$, $L=150\mu\text{H}$



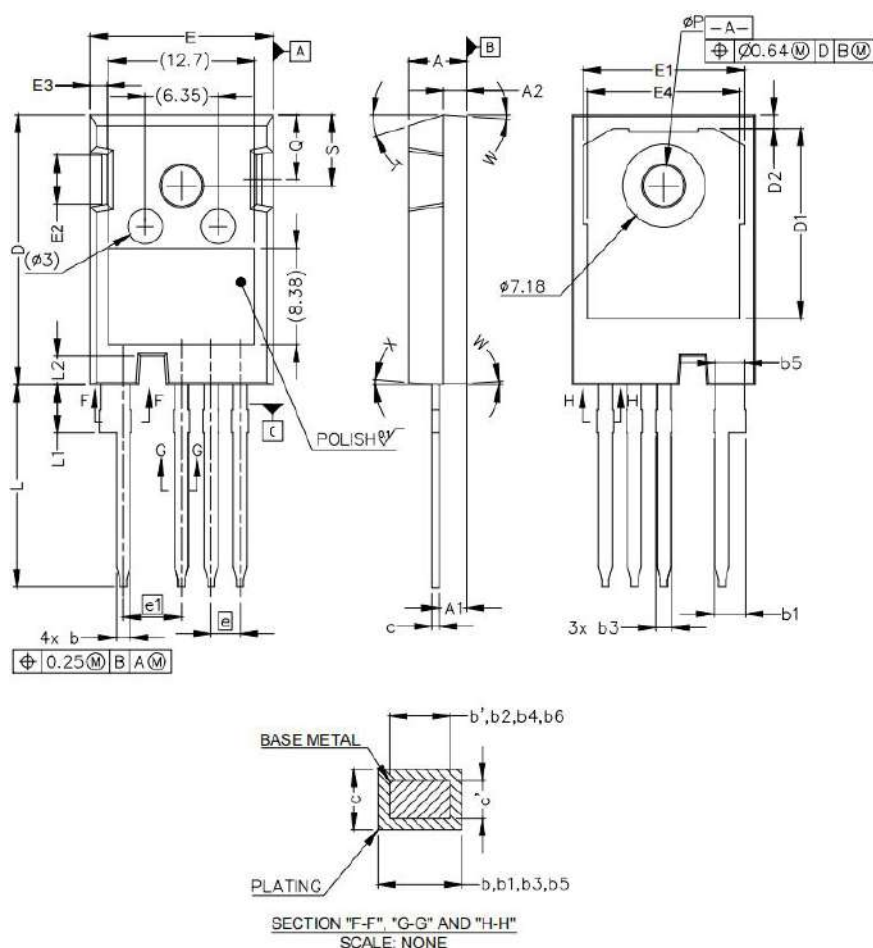
开关时间

Switching Times

Switching Times=f($R_{G\text{ ext}}$), $T_{vj}=25^\circ\text{C}$, $V_{DS}=800\text{V}$, $I_D=70\text{A}$,
 $V_{GS}=-5\text{V}/+18\text{V}$, $L=150\mu\text{H}$



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
ϕP	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
2025-07-04	正式版

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Part of the data provided in this manual is the typical value of the product, the actual factory test data and the typical value are slightly different, but our company guarantees that these differences will not affect the normal use of the product, if the product information changes, our company will update the manual in time, please pay attention at any time；

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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；

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