

HC020N065R4R

650V N-Channel SiC MOSFET

产品特点/Product features

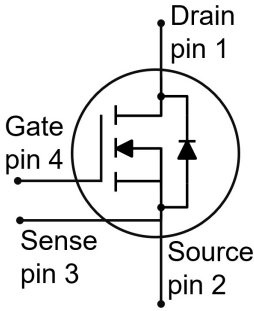
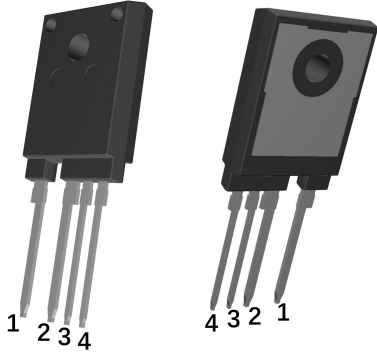
- Kelvin source configuration
开尔文源极配置
- Low specific on-resistance
低导通电阻
- Optimized dynamic performance
优化的动态性能
- Robust gate design
可靠的栅极设计
- 0V turn-off V_{GS} for simple gate driving
0V关断栅源电压，简化栅极驱动
- 100% UIS Tested
100% UIS测试
- Easy to parallel
易于并联

应用领域/Applications

- UPS & Energy storage system
不间断电源（UPS）和储能系统
- PC/server/telecom power supplies
计算机/服务器/通信电源
- Battery formation instrument
电池化成设备
- PV MPPT and inverters
光伏最大功率点追踪与逆变器
- EV Charger
电动汽车充电桩
- Motor Drives
电机驱动

关键性能参数/Key Performance Parameters

Parameter	Value	Unit
V_{DSS}	650	V
$R_{DS(on),typ}$	20	$m\Omega$
I_{DM}	264	A



Type/型号	Package/封装	Marking/标识	Packaging method/包装方式
HC020N065R4R	TO247-4L(HC)	HC020N065R	Tube/管装

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1. Maximum ratings at $T_j = 25^\circ\text{C}$, unless otherwise specified.

最大额定值 默认 $T_j = 25^\circ\text{C}$ 除非另有说明

Table 1 Maximum ratings/最大额定值

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value 值	Unit 单位
Drain-source voltage 漏极-源极电压	V_{DS}	$T_j \geq 25^\circ\text{C}$	650	V
Drain current ¹ 连续漏极电流	I_D	$T_C = 25^\circ\text{C}, V_{GS} = 18\text{V}$	132	A
		$T_C = 100^\circ\text{C}, V_{GS} = 18\text{V}$	93	
Peak drain current ² 峰值漏极电流	I_{DM}	$T_j \leq 175^\circ\text{C}$	264	A
Continuous diode current ¹ 连续二极管电流	I_S	$T_C = 25^\circ\text{C}, V_{GS} = -4\text{V}$	89	A
Peak diode current ² 峰值二极管电流	I_{SM}	$T_C = 25^\circ\text{C}, V_{GS} = -4\text{V}$	264	A
Maximum gate source voltage 栅源最大电压	$V_{GS,MAX}$		-10~22	V
Recommend gate source voltage 推荐的栅源电压	$V_{GS,op}$		-4~18	V
Avalanche energy, single pulse 单脉冲雪崩能量	E_{AS}	$I_{AS} = 23.6\text{A}, V_{DD} = 100\text{V}, L = 1\text{mH}$	278	mJ
Power dissipation ¹ 总耗散功率	P_{tot}	$T_C = 25^\circ\text{C}$	500	W
		$T_C = 100^\circ\text{C}$	250	
Mounting torque 安装扭矩	M_d	M3 and M3.5 screw M3或者M3.5螺钉	0.6	Nm

1. Limited by $T_j(\text{max})$ /受限于最大结温

2. Pulse width t_p limited by $T_j(\text{max})$ /脉宽受限于最大结温



2. Thermal characteristics

热特性

Table 2 Thermal characteristics/热特性

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value/值			Unit 单位
			Min.	Typ.	Max.	
Storage Temperature 存储温度	T _{stg}		-55		175	°C
Operating junction Temperature 工作结温	T _j		-55		175	°C
Thermal resistance, junction-case 结-壳热阻	R _{th(j-c)}			0.3		K/W
Thermal resistance, junction-ambient 结-环境热阻	R _{th(j-a)}			40		K/W
Soldering temperature 焊接温度	T _{sold}				260	°C



3. Electrical characteristics at $T_j = 25^\circ\text{C}$, unless otherwise specified.

电气特性 默认 $T_j = 25^\circ\text{C}$ 除非另有说明

Table 3 Static characteristics/静态特性

Parameter 参数	Symbol 符号	Test conditions 测试条件		Value/值			Unit 单位
				Min.	Typ.	Max.	
Drain-source breakdown voltage 漏源击穿电压	$V_{(BR)DSS}$	$I_D = 100\mu\text{A}, V_{GS} = 0\text{V}$		650			V
Gate threshold voltage 门极开启阈值电压	$V_{GS(th)}$	$I_D = 11\text{mA}, V_{DS} = V_{GS}$	$T_j = 25^\circ\text{C}$	1.9	2.6	3.5	V
			$T_j = 175^\circ\text{C}$		1.9		
Drain-source on-state resistance 漏极-源极导通电阻	$R_{DS(on)}$	$I_D = 45\text{A}, V_{GS(on)} = 15\text{V}$	$T_j = 25^\circ\text{C}$		25		m Ω
			$T_j = 25^\circ\text{C}$		20	26	
		$I_D = 45\text{A}, V_{GS(on)} = 18\text{V}$	$T_j = 175^\circ\text{C}$		24		
Zero gate voltage drain current 集电极-发射极漏电	I_{DSS}	$V_{DS} = 650\text{V}, V_{GS} = 0\text{V}$	$T_j = 25^\circ\text{C}$		0.1	50	μA
			$T_j = 175^\circ\text{C}$		5		
Gate to source Leakage current 门极-源极漏电流	I_{GSS}	$V_{DS} = 0\text{V}, V_{GS} = 22\text{V}, T_j = 25^\circ\text{C}$				100	nA
		$V_{DS} = 0\text{V}, V_{GS} = -10\text{V}, T_j = 25^\circ\text{C}$				100	
Forward transconductance 正向跨导	g_{fs}	$I_D = 45\text{A}, V_{DS} = 20\text{V}$			30		S
Integrated gate resistor 内部门极电阻	R_G	$f = 1\text{MHz}$			1.01		Ω

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Table 4 Dynamic characteristics/动态特性

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value/值			Unit 单位
			Min.	Typ.	Max.	
Total gate charge 总栅极电荷	$Q_{G(tot)}$	$V_{DD}=400V$, $I_D=45A$, $V_{GS}=-4/18V$		123		nC
Gate source charge 栅-源极电荷	Q_{GS}			51		
Gate-drain charge 栅-漏极电荷	Q_{GD}			15.2		
Input capacitance 输入电容	C_{iss}	$V_{DS}=400V$, $V_{GS}=0V$, $f=1MHz$		2840		pF
Output capacitance 输出电容	C_{oss}			231		
Reverse transfer capacitance 反向传输电容	C_{rss}			15		
Coss stored energy 输出电容存储能量	E_{oss}	Calculated based on C_{oss}		18.5		μJ
Turn-On Delay Time 开启延迟时间	$t_{d(on)}$	$V_{DD}=400V$, $I_D=22.5A$, $V_{GS}=-4/18V$, $R_{G(ext)}=5.1\Omega$, $L=100\mu H$		22		ns
Rise time 上升时间	t_r			17		
Turn-Off Delay Time 关闭延迟时间	$t_{d(off)}$			51		
Turn-Off Fall Time 下降时间	t_f			12		
Turn-on switch loss 单次开启损耗	E_{on}			85		μJ
Turn-off switch loss 单次关闭损耗	E_{off}			34		

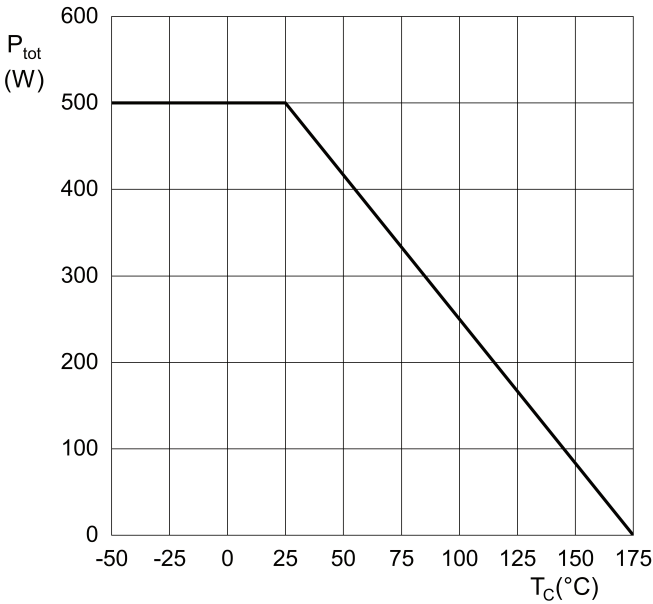
Table 5 Reverse diode characteristics/体二极管反向特性

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value/值			Unit 单位
			Min.	Typ.	Max.	
Drain-source reverse voltage 体二极管正向压降	V_{SD}	$I_S=45A, V_{GS}=0V, T_j=25^\circ C$		3.7		V
		$I_S=45A, V_{GS}=-4V, T_j=25^\circ C$		4.2		
		$I_S=45A, V_{GS}=-4V, T_j=175^\circ C$		3.7		
MOSFET forward recovery time MOSFET正向恢复时间	t_{fr}	$V_{DS}=400V$, $I_S=45A$, $-di_S/dt=500A/\mu s$		36		ns
MOSFET forward recovery charge MOSFET正向恢复电荷	Q_{fr}			133		nC
MOSFET peak forward recovery current MOSFET正向恢复峰值电流	I_{frm}			7.4		A

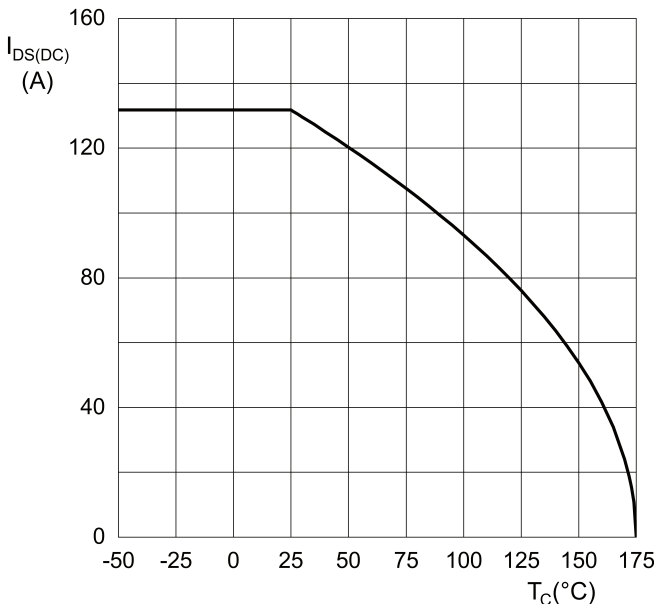


4. Electrical characteristics diagrams
电气特性图表

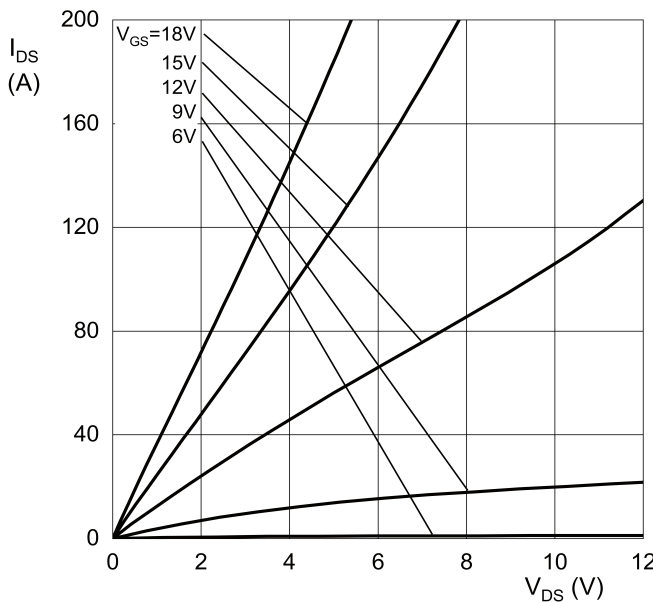
Power dissipation/耗散功率
 $P_{tot}=f(T_c)$



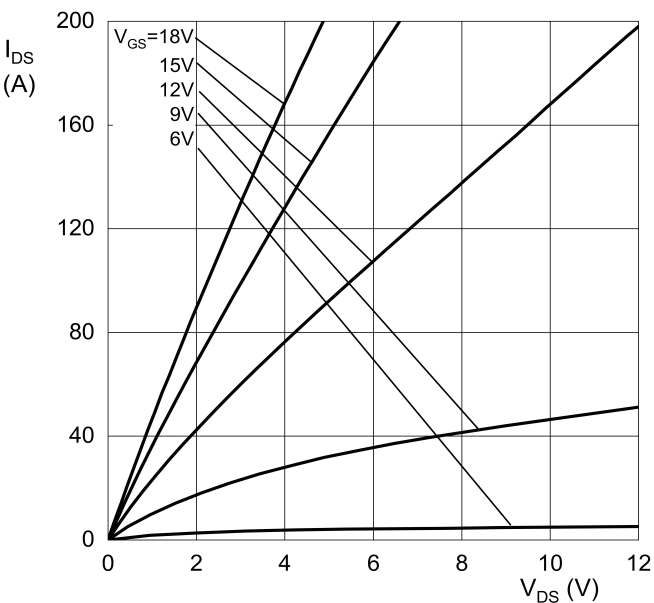
Continuous Drain Current/连续漏电流与壳温
 $I_{DS}=f(T_c); V_{GS} \geq 18V$



Typ Output Characteristic/典型输出特性
 $I_{DS}=f(V_{DS}); T_c=-55^{\circ}C$



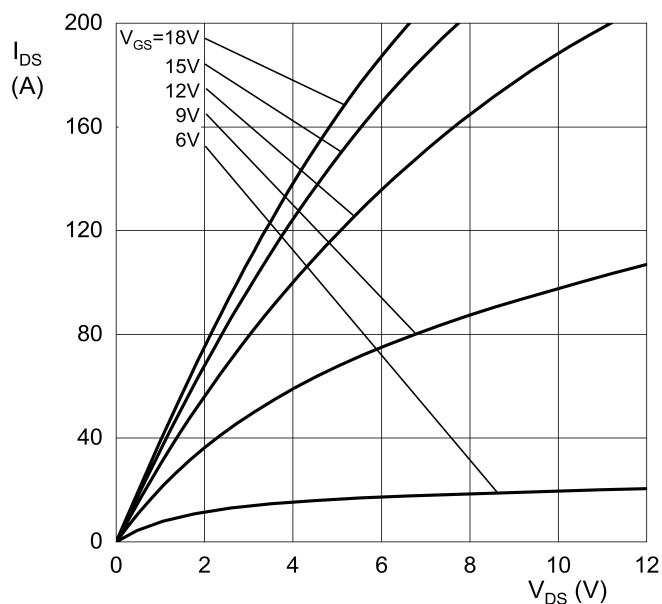
Typ Output Characteristic/典型输出特性
 $I_{DS}=f(V_{DS}); T_c=25^{\circ}C$





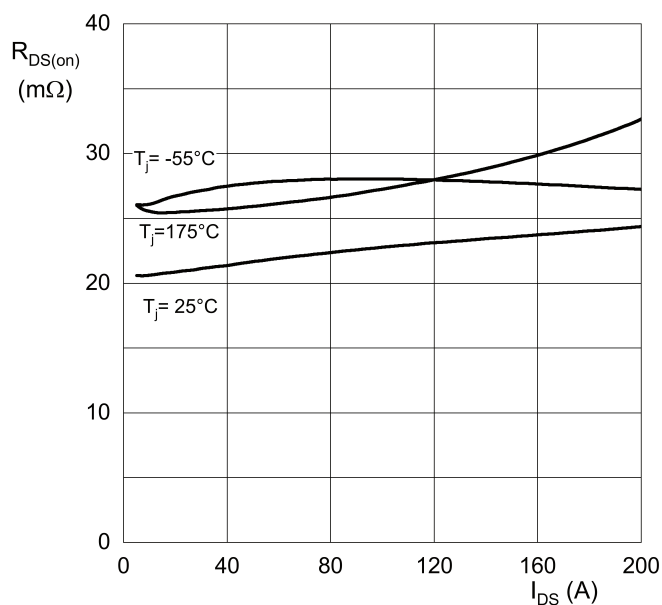
Typ output characteristic/典型输出特性

$I_{DS}=f(V_{DS}); T_C=175^{\circ}\text{C}$



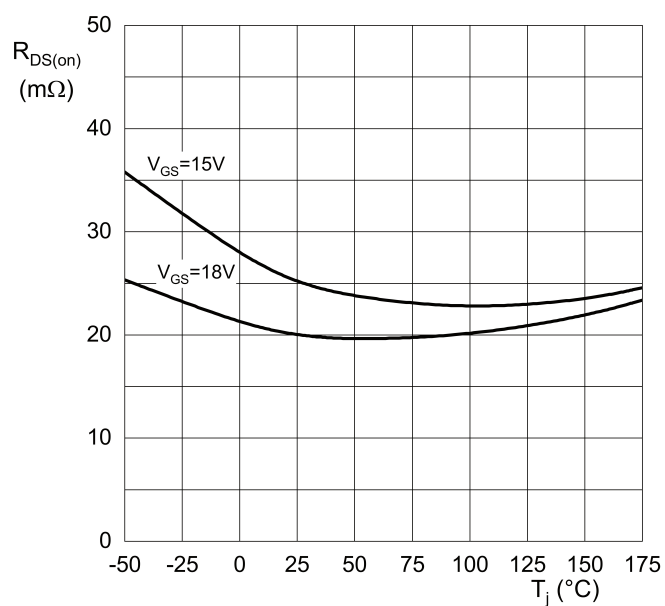
Typ.drain-source on-state resistance/典型漏源导通电阻

$R_{DS(on)}=f(I_{DS}); V_{GS}=18\text{V}$



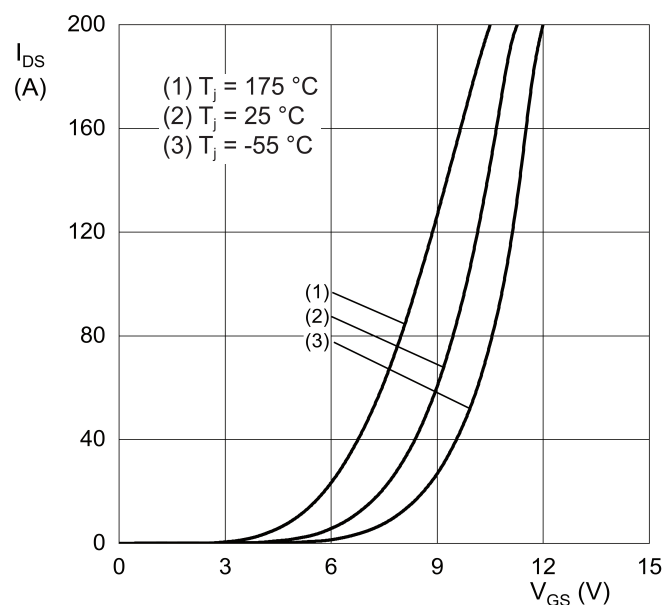
Drain-source on-state resistance/漏源导通电阻

$R_{DS(on)}=f(T_j); I_{DS}=45\text{A}$

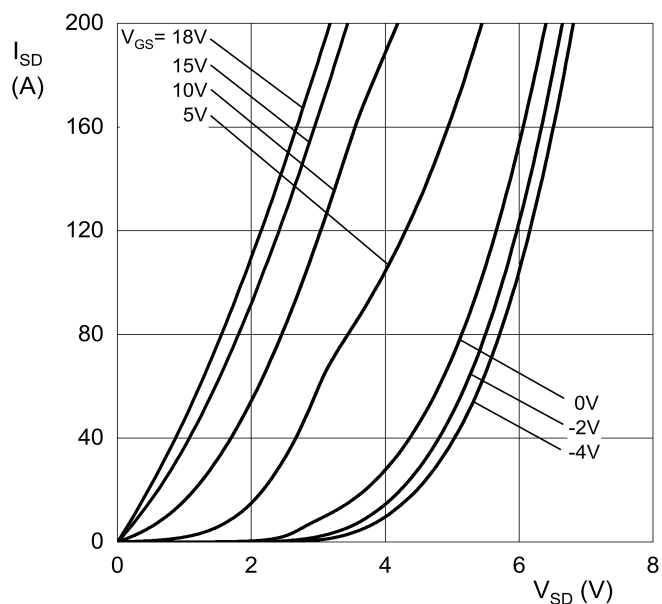


Typ Transfer characteristics/传输特性

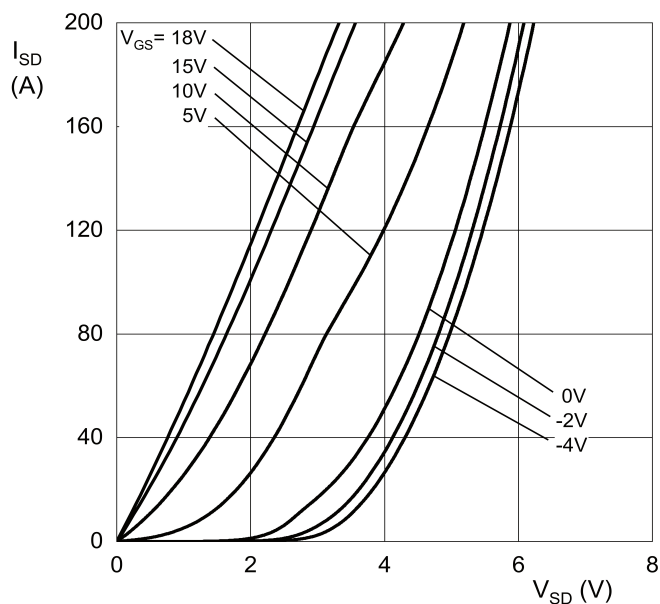
$I_{DS}=f(V_{GS}); V_{DS}=20\text{V}$



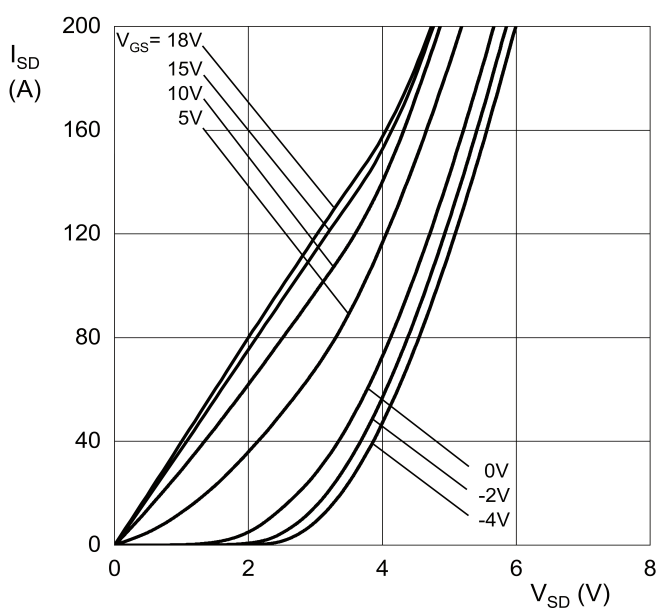
Typ.reverse drain current characteristics/典型二极管特性
 $I_{SD}=f(V_{SD})$; $T_C=-55^{\circ}\text{C}$



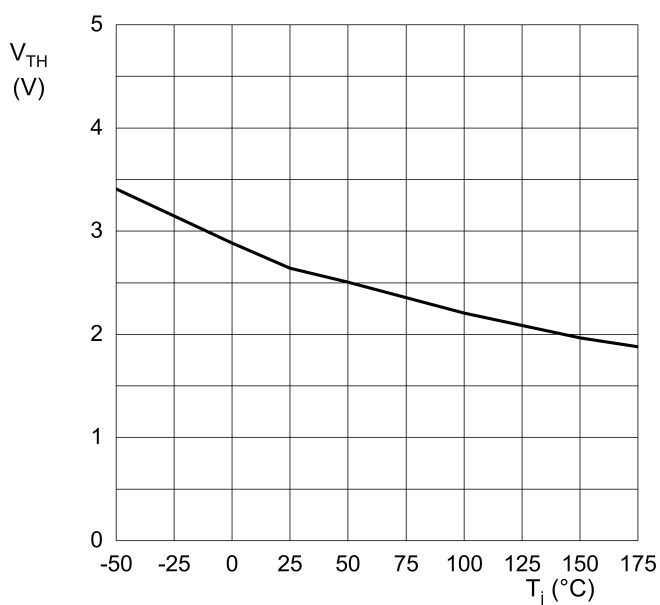
Typ.reverse drain current characteristics/典型二极管特性
 $I_{SD}=f(V_{SD})$; $T_C=25^{\circ}\text{C}$



Typ.reverse drain current characteristics/典型二极管特性
 $I_{SD}=f(V_{SD})$; $T_C=175^{\circ}\text{C}$



Typ.Gate threshold voltage/门级阈值电压结温特性
 $V_{Gsth}=f(T_j)$; $I_D=11\text{mA}$, $V_{DS}=V_{GS}$

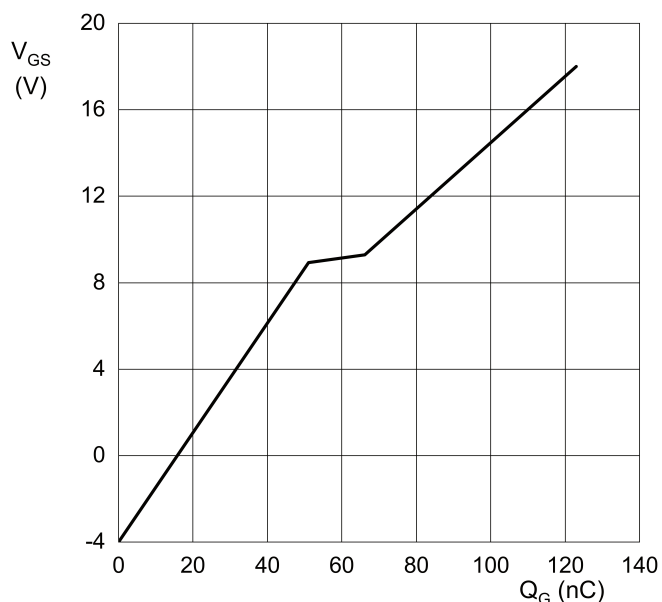


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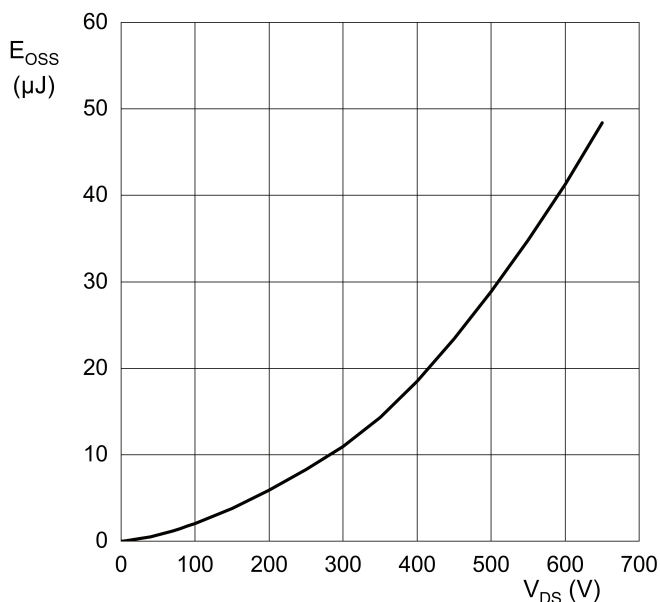
Typ.gate charge/典型门级电荷

$V_{GS}=f(Q_G)$; $I_{DS}=45A$, $I_{GS}=0.1mA$, $V_{DS}=400V$



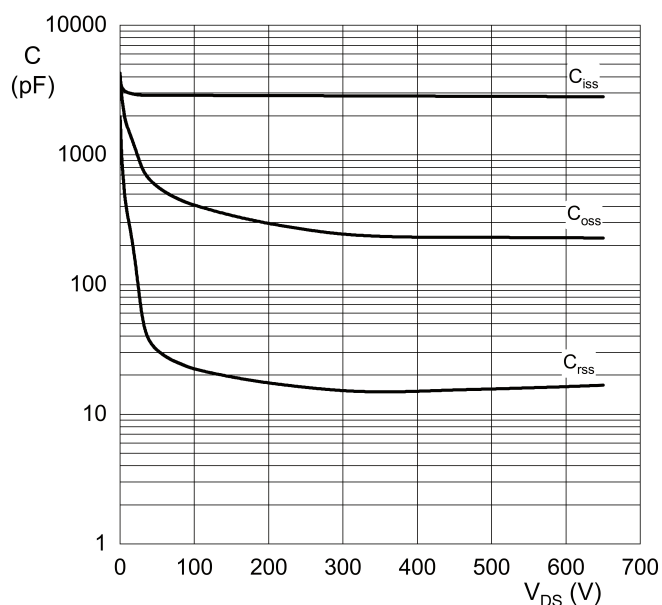
Typ.Coss stored energy/典型Coss存储能量

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



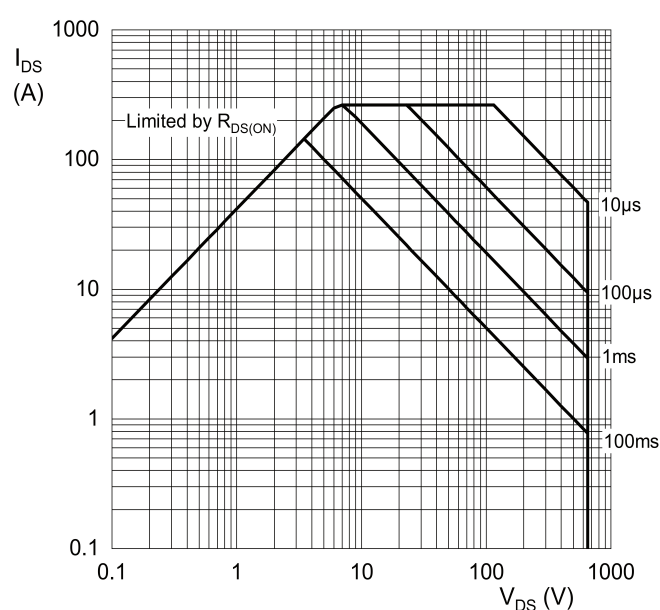
Typ. capacitances/典型电容特性

$C=f(V_{DS})$; $V_{GS}=0V$



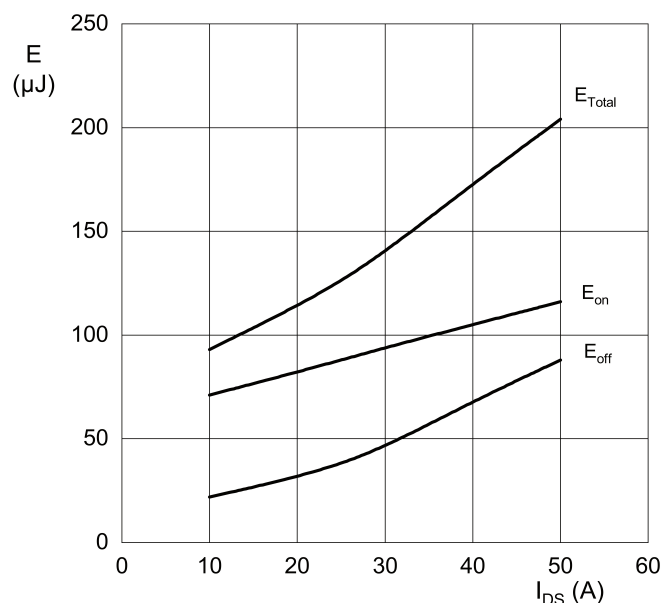
Forward bias safe operating area/安全工作区

$I_D=f(V_{DS})$; $T_c=25^\circ C$, $D=0$

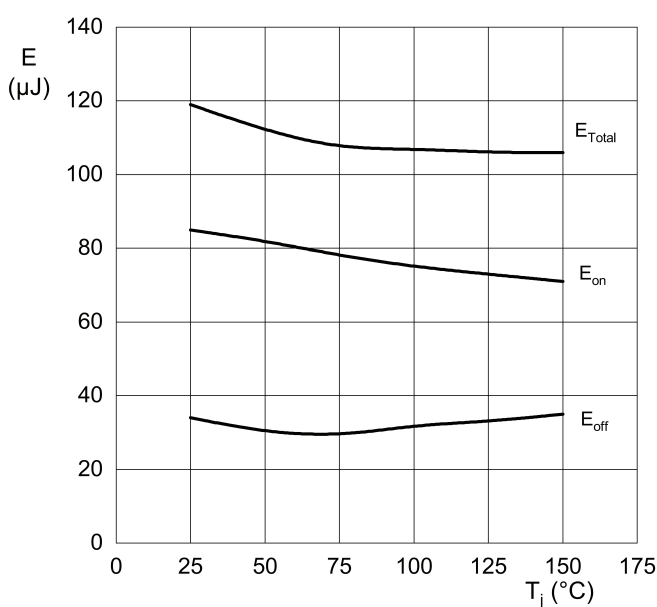




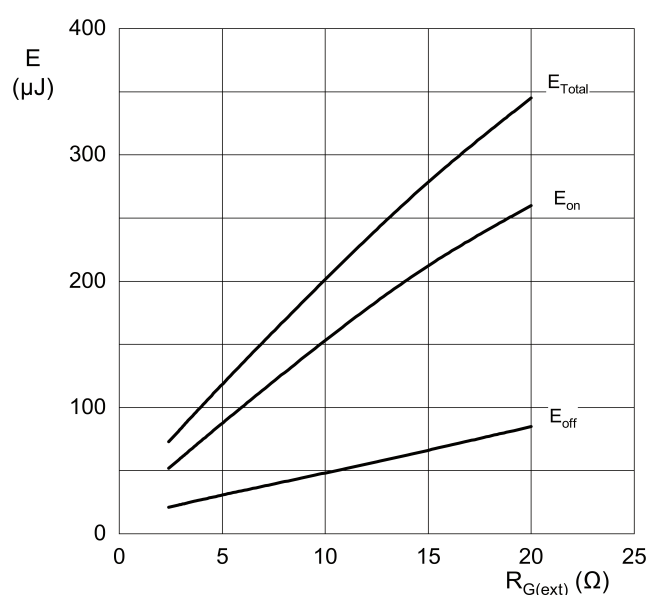
Typ. Switching Losses vs current /动态损耗-电流特性
 $E=f(I_D)$; $V_{GS}=-4/18V$, $R_G=5.1\Omega$, $V_{DD}=400V$, $T_J=25^\circ C$



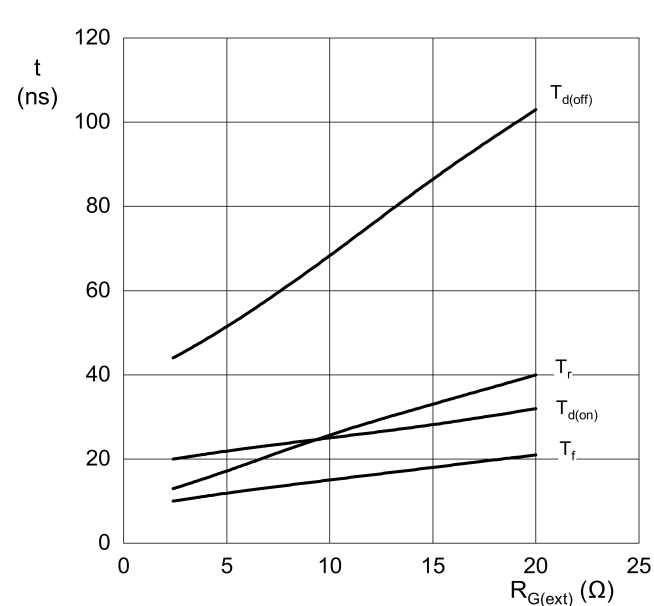
Typ. Switching losses vs temperature/动态损耗-结温特性
 $E=f(T_J)$; $V_{GS}=-4/18V$, $R_G=5.1\Omega$, $V_{DD}=400V$, $I_D=22.5A$



Typ. Switching losses vs resistance/动态损耗-门级电阻特性
 $E=f(R_G)$; $V_{GS}=-4/18V$, $V_{DD}=400V$, $I_D=22.5A$, $T_J=25^\circ C$



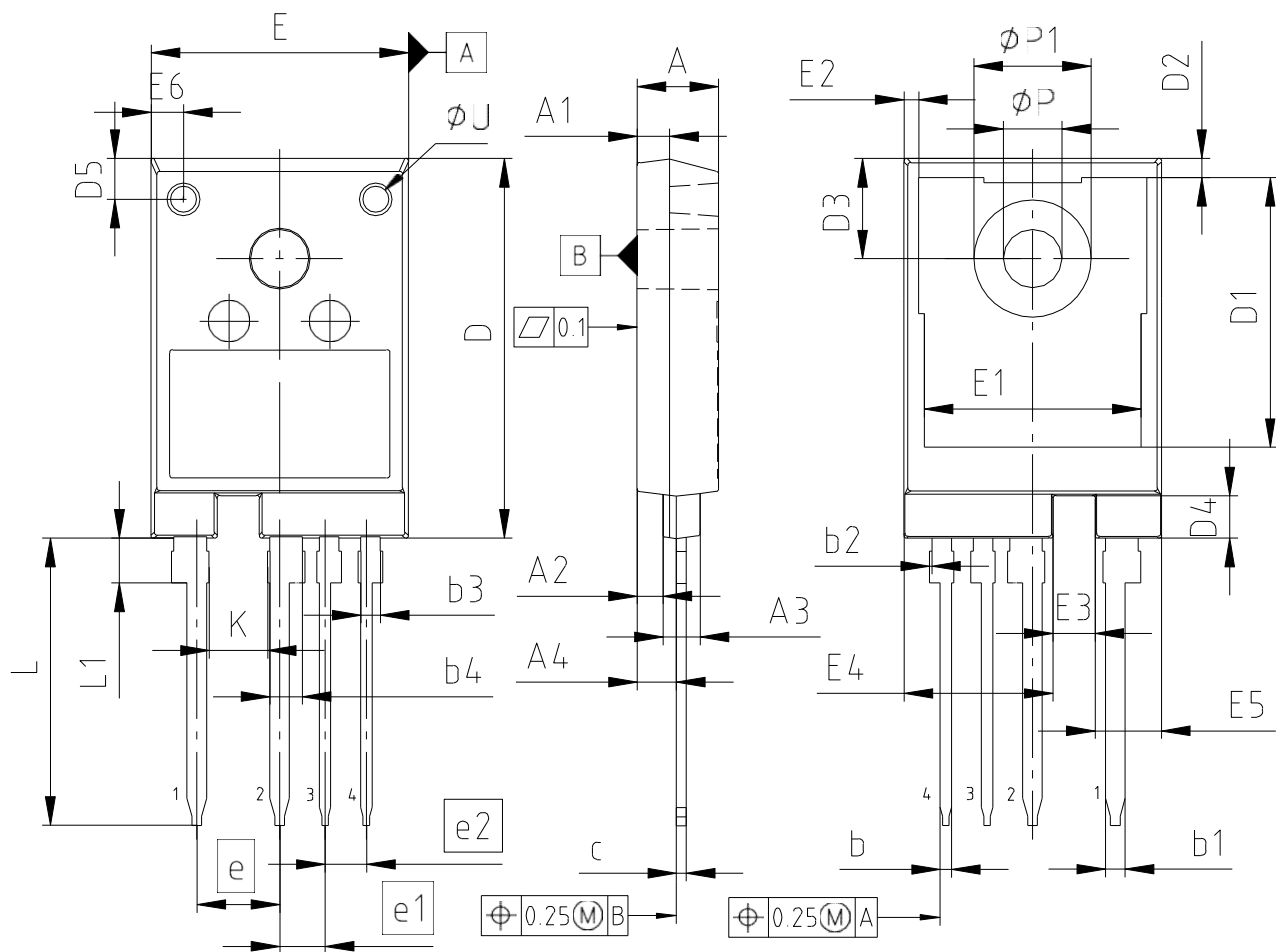
Typ. Switching times vs resistance/开关时间-门级电阻特性
 $t=f(R_G)$; $V_{GS}=-4/18V$, $V_{DD}=400V$, $I_D=22.5A$, $T_J=25^\circ C$





5. Package outline
封装外形

Figure 1. Outline TO-247-4L(HC), dimensions in mm/TO-247-4L(HC)外形尺寸 (毫米)



DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	E	15.60	20.00
A1	1.90	2.10	E1	13.10	13.50
A2	1.50	1.70	E2	0.60	1.20
A3	2.20	2.36	E3	2.48	2.68
A4	2.31	2.51	E4	9.05	9.25
b	0.60	0.80	E5	3.97	4.17
b1	1.10	1.30	E6	1.80	2.20
b2	---	0.15	e	5.08	
b3	1.10	1.30	e1	2.79	
b4	1.90	2.10	e2	2.54	
c	0.50	0.70	K	3.50	---
D	23.10	23.50	L	17.50	17.80
D1	20.25	20.85	L1	2.61	2.91
D2	0.97	1.37	N	4	
D3	6.00	6.30	ØP1	7.00	7.40
D4	2.50	2.70	ØP	3.50	3.70
D5	2.30	2.70	ØU	1.40	1.80

NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
注：不计模具飞边或凸起



6. Revision history

Table 6 Date and version number/日期与版本号

Date日期	Revision版本	Changes更改内容
2025-09-15	Rev. G 1.0	Target Datasheet (目标规格书)

7. Matters needing attention

Appendix 1. Important Technical Guidance, Application Policy, and Copyright Notice/重要技术指南、应用规范与版权声明

[Data and Design Guidance]

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