

HC016N065D7R

650V N-Channel SiC MOSFET

产品特点/Product features

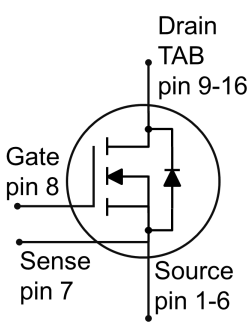
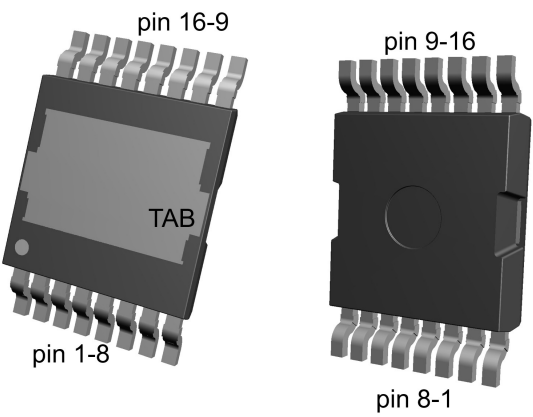
- Kelvin source configuration
开尔文源极配置
- Low specific on-resistance
低导通电阻
- Optimized dynamic performance
优化的动态性能
- Robust gate design
可靠的栅极设计
- 0V turn-off V_{GS} for simple gate driving
0V关断栅源电压，简化栅极驱动
- 100% UIS Tested
100% UIS测试
- Easy to parallel
易于并联

应用领域/Applications

- Automotive Motor Control
汽车电机控制
- Brushless DC (BLDC) and DC Motor Drives
无刷及直流电机驱动
- DC/DC Converters and Power Management
DC/DC 转换器与电源管理
- Industrial Automation Systems
工业自动化系统
- Power Tools and HVAC Applications
电动工具及汽车空调系统

关键性能参数/Key Performance Parameters

Parameter	Value	Unit
V_{DSS}	650	V
$R_{DS(on),typ}$	16	mΩ
I_{DM}	309	A



Type/型号	Package/封装	Marking/标识	Packaging method/包装方式
HC016N065D7R	TOLT	HC016N065R	Tape and Reel/卷带包装



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_{DSS}	$T_j \geq 25^\circ\text{C}$	650	V
Drain current ¹ 连续漏极电流	I_{D}	$T_c = 25^\circ\text{C}, V_{\text{GS}} = 18\text{V}$	154	A
		$T_c = 100^\circ\text{C}, V_{\text{GS}} = 18\text{V}$	109	
Peak drain current ² 峰值漏极电流	I_{DM}	$T_j \leq 175^\circ\text{C}$	309	A
Continuous diode current ¹ 连续二极管电流	I_{S}	$T_c = 25^\circ\text{C}, V_{\text{GS}} = -4\text{V}$	120	A
Peak diode current ² 峰值二极管电流	I_{SM}	$T_c = 25^\circ\text{C}, V_{\text{GS}} = -4\text{V}$	309	A
Maximum gate source voltage 栅源最大电压	$V_{\text{GS,MAX}}$		-10~22	V
Recommend gate source voltage 推荐的栅源电压	$V_{\text{GS,op}}$		-4~18	V
Avalanche energy, single pulse 单脉冲雪崩能量	E_{AS}	$I_{\text{AS}} = 33\text{A}, V_{\text{DD}} = 100\text{V}, L = 1\text{mH}$	544	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	

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

2. Pulse width t_p limited by $T_{\text{j(max)}}$ /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
Soldering temperature, reflow solderin 焊接温度，回流焊	T _{sold}	reflow MSL1			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	$V_{GS(th)}$	$I_D = 14\text{mA}, V_{DS} = V_{GS}$	$T_j = 25^\circ\text{C}$	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	$R_{DS(on)}$	$I_D = 55\text{A}, V_{GS(on)} = 15\text{V}$	$T_j = 25^\circ\text{C}$		20		m Ω
			$T_j = 25^\circ\text{C}$		16	21	
		$I_D = 55\text{A}, V_{GS(on)} = 18\text{V}$	$T_j = 175^\circ\text{C}$		21		
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}	$I_D = 55\text{A}, V_{DS} = 20\text{V}$			33		S
Integrated gate resistor 内部门极电阻	R_G	$f = 1\text{MHz}$			0.8		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.	
Input capacitance 输入电容	C_{iss}	$V_{DS}=400V$, $V_{GS}=0V$, $f=1MHz$		4794		pF
Output capacitance 输出电容	C_{oss}			400		
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}		200		μJ
Total gate charge 总栅极电荷	$Q_{G(tot)}$	$V_{DD}=400V$, $I_D=20A$, $V_{GS}=-4/18V$		191		nC
Gate source charge 栅-源极电荷	Q_{GS}			74		
Gate-drain charge 栅-漏极电荷	Q_{GD}			28		
Turn-On Delay Time 开启延迟时间	$t_{d(on)}$	$V_{DD}=400V$, $I_D=27.5A$, $V_{GS}=-4/18V$, $R_{G(ext)}=5.1\Omega$, $L=100\mu H$		15		ns
Rise time 上升时间	t_r			24		
Turn-Off Delay Time 关闭延迟时间	$t_{d(off)}$			64		
Turn-Off Fall Time 下降时间	t_f			18		
Turn-on switch loss 单次开启损耗	E_{on}			230		μJ
Turn-off switch loss 单次关闭损耗	E_{off}			27		

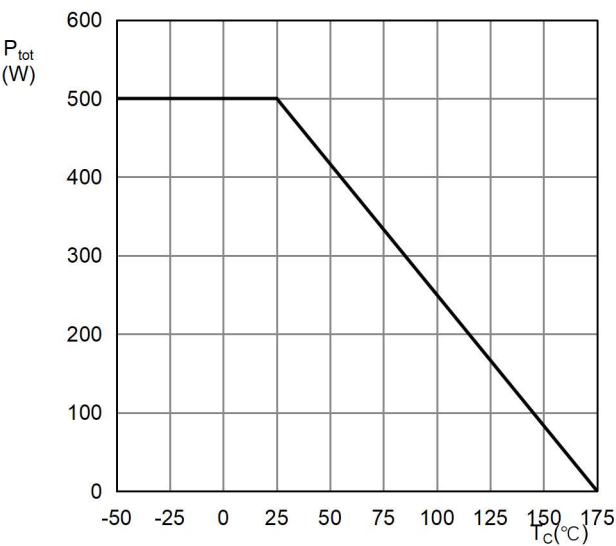
Table 5 Reverse diode characteristics/体二极管反向特性

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}	$I_S=55A, V_{GS}=0V, T_j=25^\circ C$		3.4		V
		$I_S=55A, V_{GS}=-4V, T_j=25^\circ C$		3.9		
		$I_S=55A, V_{GS}=-4V, T_j=175^\circ C$		3.4		
MOSFET forward recovery time MOSFET正向恢复时间	t_{fr}	$V_{DS}=400V$, $I_S=55A$, $-di/dt=500A/\mu s$		47		ns
MOSFET forward recovery charge MOSFET正向恢复电荷	Q_{fr}			215		nC
MOSFET peak forward recovery current MOSFET正向恢复峰值电流	I_{frm}			9.1		A

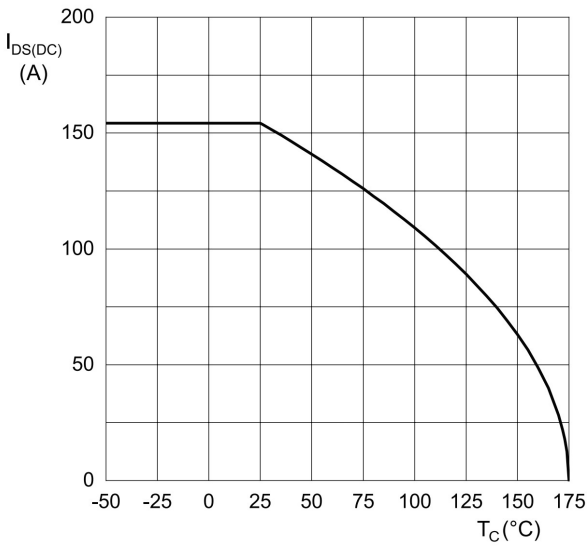


4. Electrical characteristics diagrams
电气特性图表

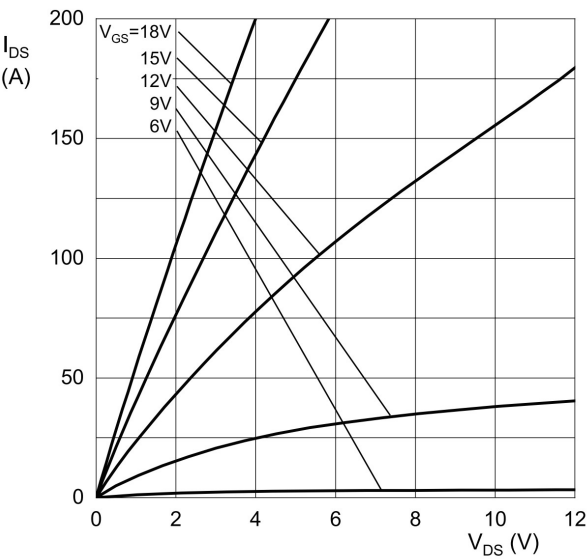
Power dissipation/耗散功率
 $P_{tot}=f(T_c)$



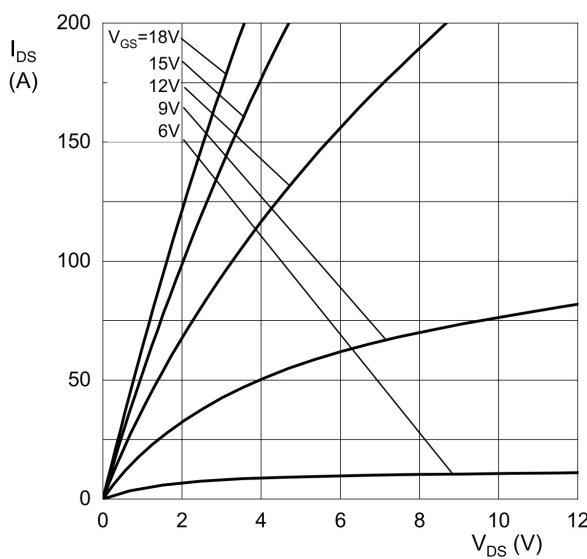
Continuous Drain Current/连续漏电流与壳温
 $I_{DS}=f(T_c); V_{GS} \geq 18V$



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

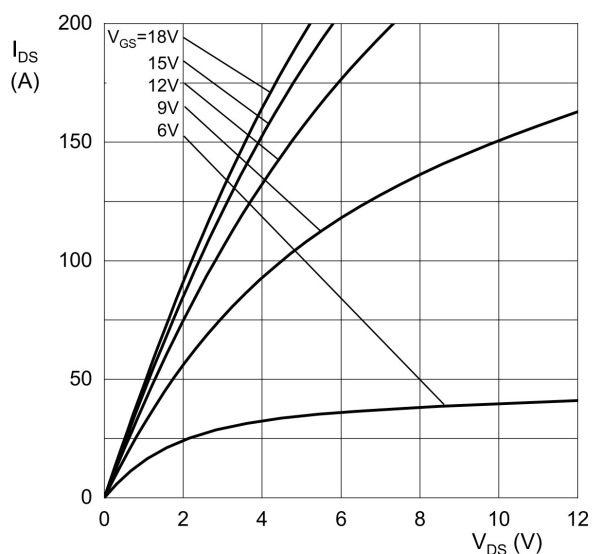


Typ Output Characteristic/典型输出特性
 $I_{DS}=f(V_{DS}); T_c=25^{\circ}C$

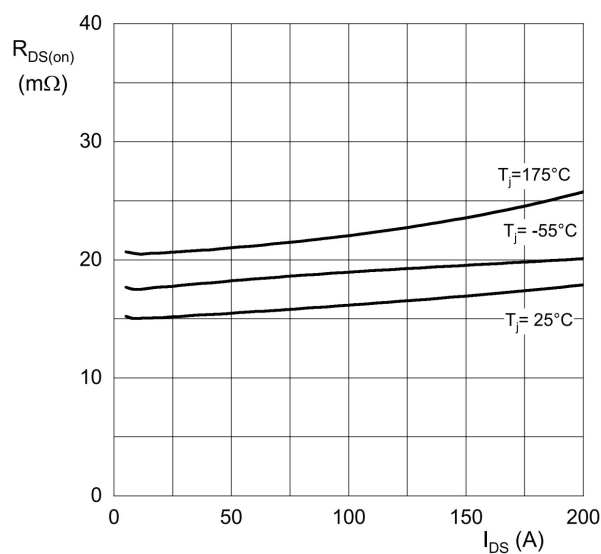




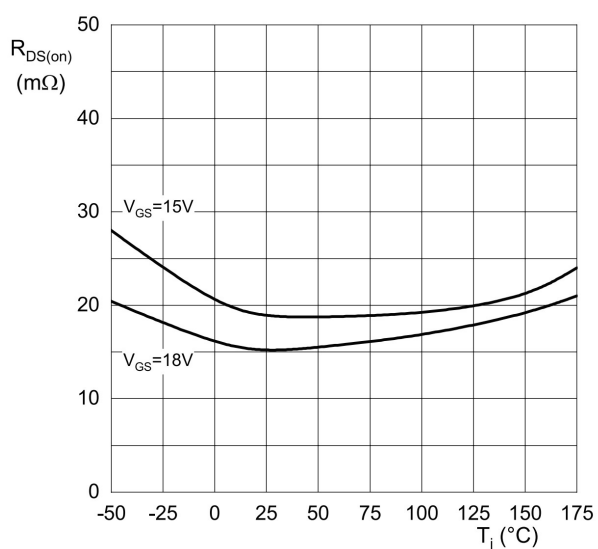
Typ output characteristic/典型输出特性
 $I_{DS}=f(V_{DS})$; $T_C=175^\circ\text{C}$



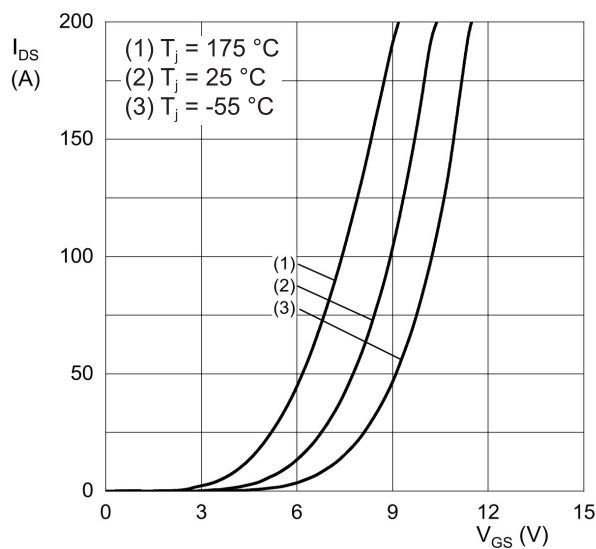
Typ. drain-source on-state resistance/典型漏源导通电阻
 $R_{DS(on)}=f(I_{DS})$; $V_{GS}=18\text{V}$



Drain-source on-state resistance/漏源导通电阻
 $R_{DS(on)}=f(T_J)$; $I_{DS}=55\text{A}$

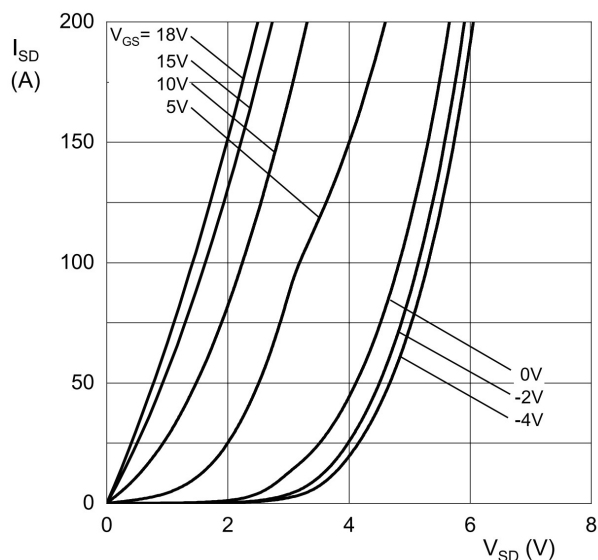


Typ Transfer characteristics/传输特性
 $I_{DS}=f(V_{GS})$; $V_{DS}=20\text{V}$

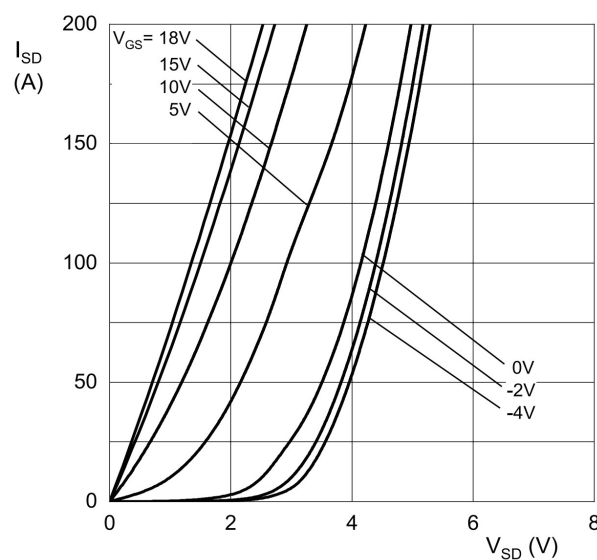




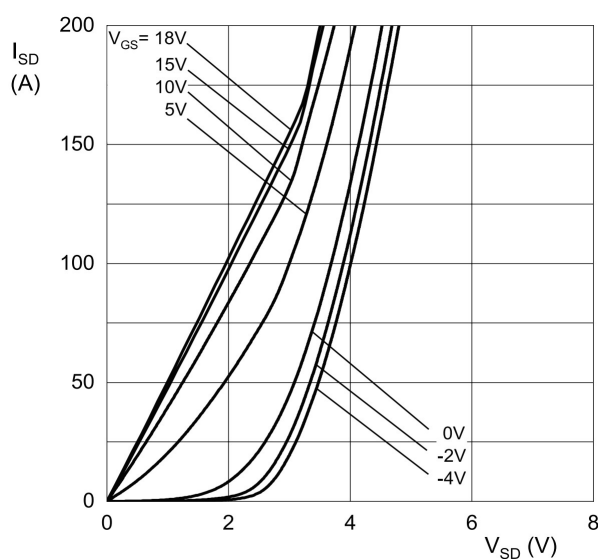
Typ.reverse drain current characteristics/典型二极管特性
 $I_{SD}=f(V_{SD})$; $T_C=-55^{\circ}\text{C}$



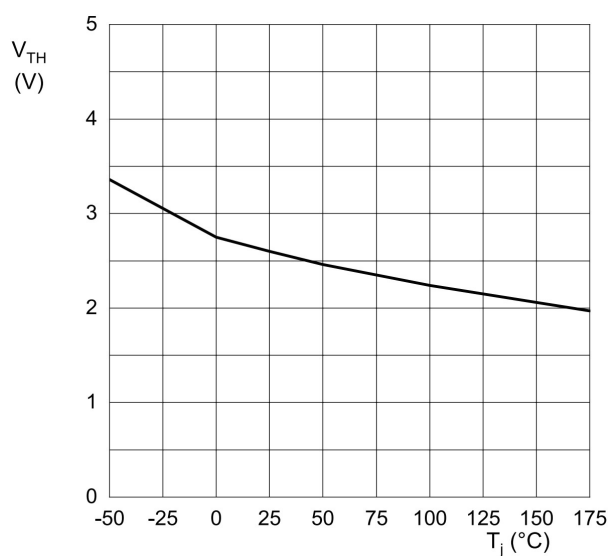
Typ.reverse drain current characteristics/典型二极管特性
 $I_{SD}=f(V_{SD})$; $T_C=25^{\circ}\text{C}$



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
 $V_{Gsth}=f(T_J)$; $I_D=14\text{mA}$, $V_{DS}=V_{GS}$

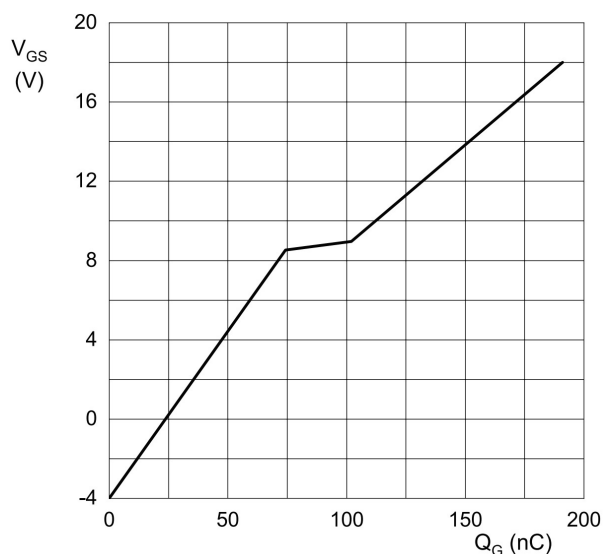


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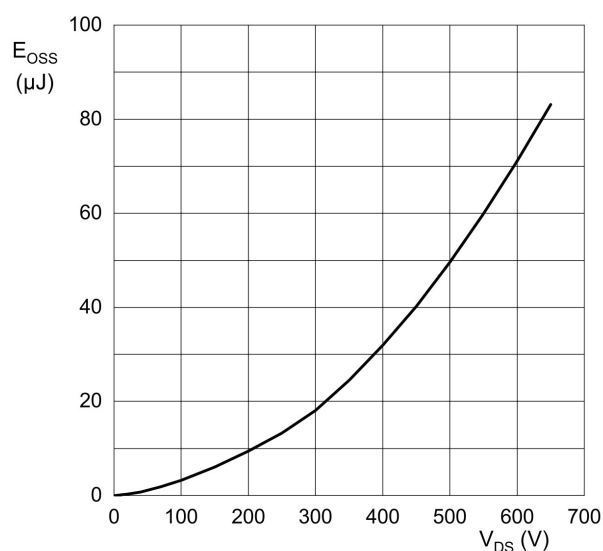
Typ.gate charge/典型门级电荷

$V_{GS}=f(Q_G)$; $I_{DS}=55A$, $I_{GS}=0.1mA$, $V_{DS}=400V$



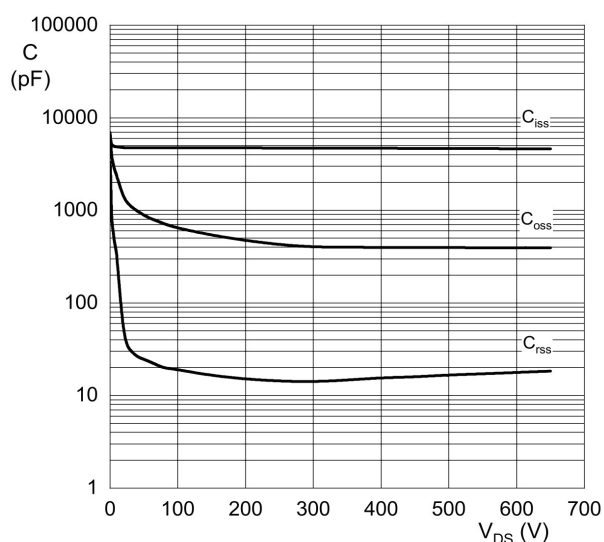
Typ.Coss stored energy/典型Coss存储能量

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



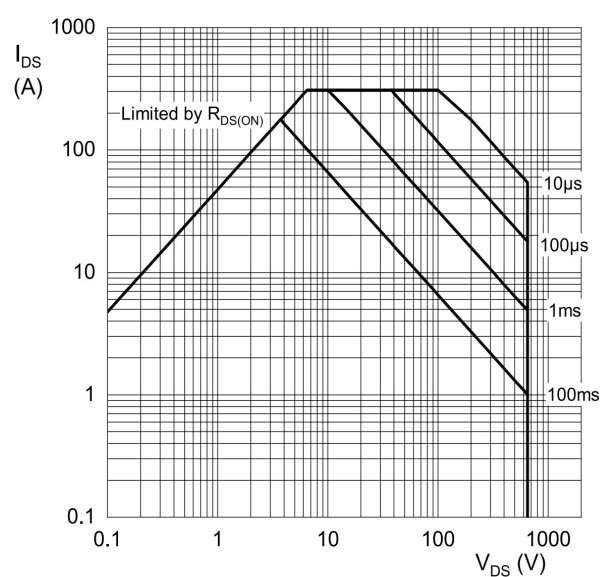
Typ. capacitances/典型电容特性

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

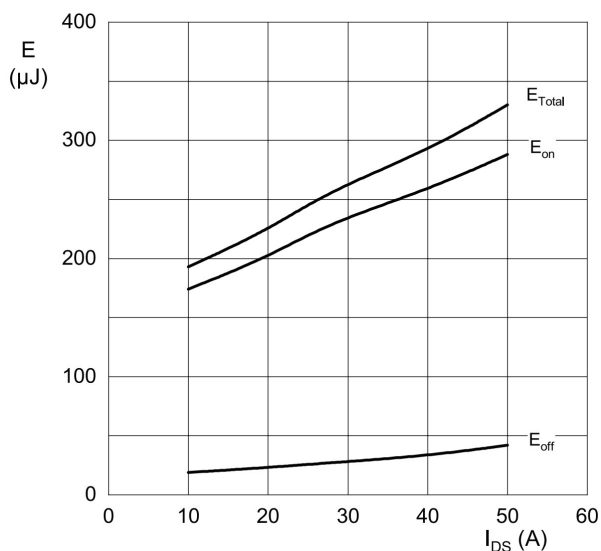


Forward bias safe operating area/安全工作区

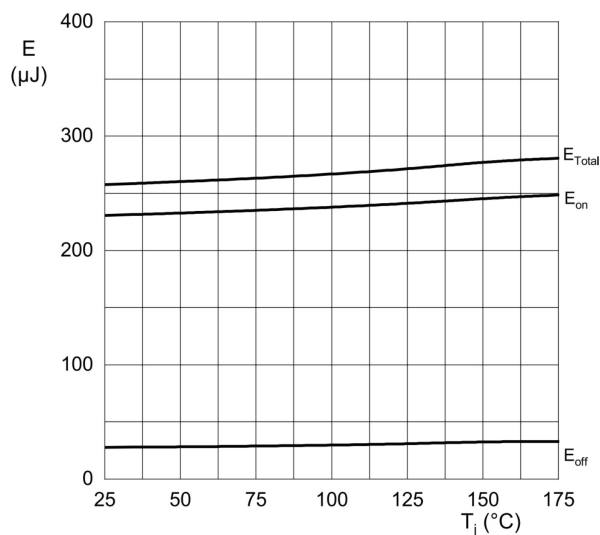
$I_D=f(V_{DS})$; $T_C=25^\circ C$, $D=0$



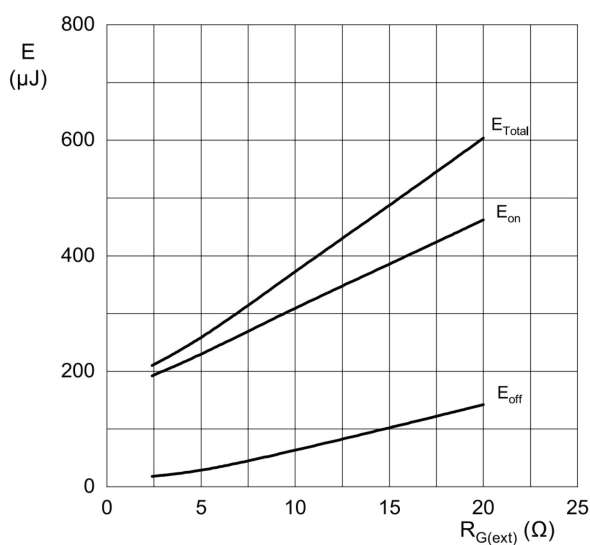
Typ. Switching Losses vs current /动态损耗-电流特性
 $E=f(I_D)$; $V_{GS}=-4/18V$, $R_G=5.1\Omega$, $V_{DD}=400V$, $T_J=25^\circ C$



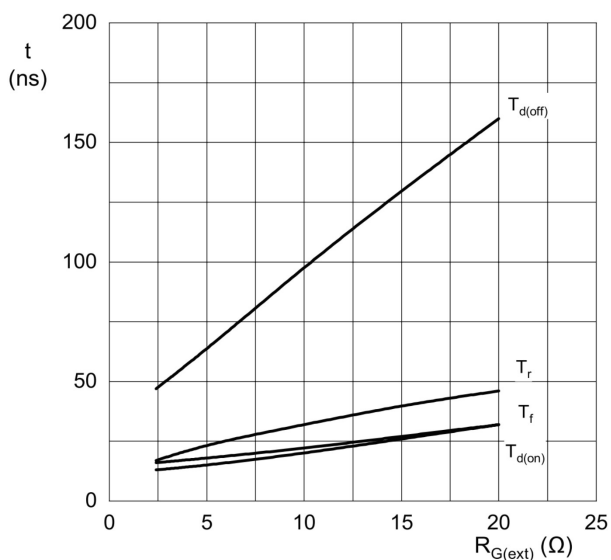
Typ. Switching losses vs temperature/动态损耗-结温特性
 $E=f(T_J)$; $V_{GS}=-4/18V$, $R_G=5.1\Omega$, $V_{DD}=400V$, $I_D=10A$



Typ. Switching losses vs resistance/动态损耗-门级电阻特性
 $E=f(R_G)$; $V_{GS}=-4/18V$, $V_{DD}=400V$, $I_D=10A$, $T_J=25^\circ C$



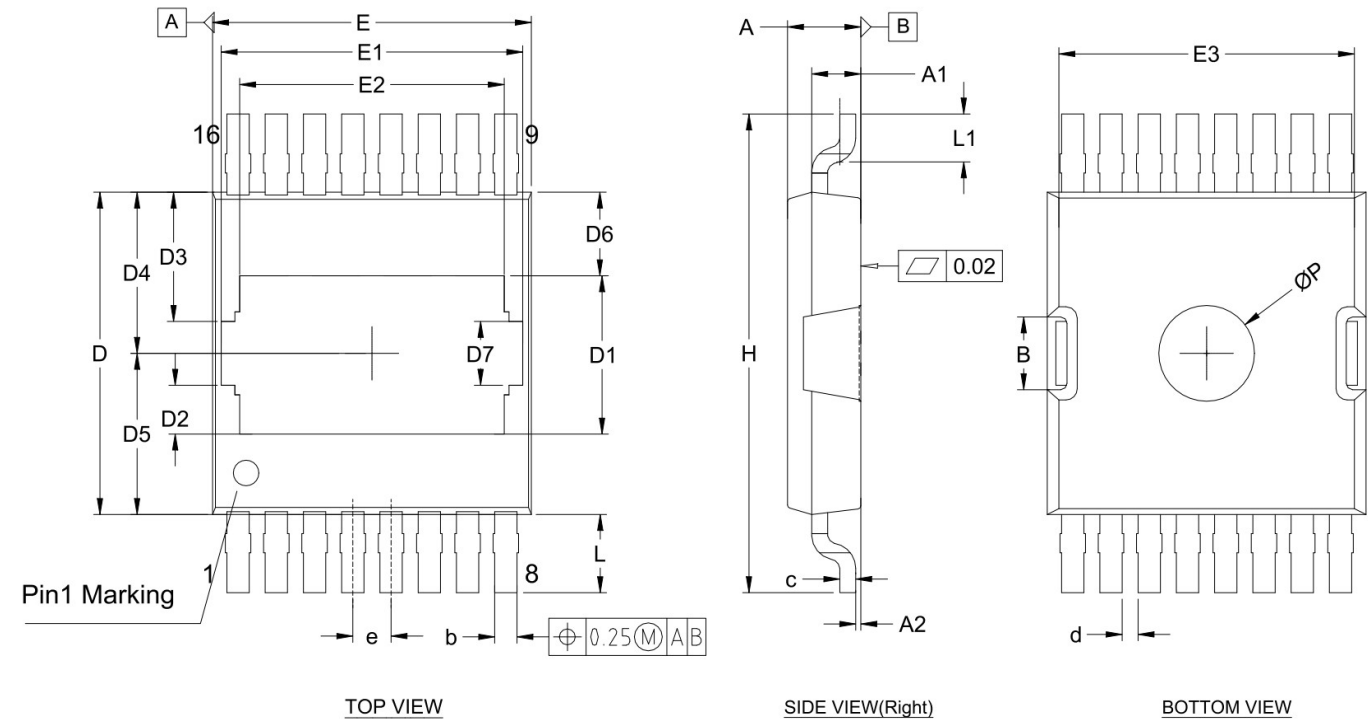
Typ. Switching times vs resistance/开关时间-门级电阻特性
 $t=f(R_G)$; $V_{GS}=-4/18V$, $V_{DD}=400V$, $I_D=10A$, $T_J=25^\circ C$





5. Package outline
封装外形

Figure 1. Outline TOLT, dimensions in mm/TOLT外形尺寸（毫米）



DIM SYMBOL	MIN.	NOM.	MAX.
A	2.25	2.30	2.35
A1	1.44	1.54	1.64
A2	0.01	---	0.16
b	0.60	0.70	0.80
c	0.40	0.50	0.60
d	0.40	0.50	0.60
e	1.200 BSC		
D	10.00	10.10	10.30
D1	4.76	4.96	5.16
D2	1.33	1.53	1.73
D3	4.05 REF.		
D4	5.05 REF.		
D5	5.05 REF.		
D6	2.62 REF.		
D7	2.00 REF.		
E	9.70	10.00	10.10
E1	9.46 REF.		
E2	8.10	8.30	8.50
E3	9.07	9.27	9.47
H	14.80	15.00	15.20
L	2.25	2.45	2.65
L1	1.35	1.50	1.65
ØP	2.90	3.00	3.10
B	2.18	2.28	2.38

NOTES/注:
DIMENSIONING AND TOLERANCING PER ASME Y14.5-1994/尺寸标注与公差遵循 ASME Y14.5-1994 标准
ALL DIMENSIONS ARE IN MILLIMETERS, ANGLES ARE IN DEGREE/所有尺寸单位为毫米，所有角度单位为度



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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