TM25S12B3A-307A

SiC MOSFET 器件 SiC MOSFET Device

关键参数 Key Parameters

V_{DSmax}		1200	V
$R_{DS(on)}$	Typ.	25	mΩ
I_D	Max.	82	A

典型应用 Typical Application

- OBC — On Board Charger
- DC-DC — DC-DC Converter
- 充电桩 — Battery Chargers
- 光伏逆变 — Solar Inverters

特点 Features

- 高开关频率 — High Switching Frequency
- 低开关损耗 — Low Switching Loss
- 软、快速开关 — Soft, fast Switching
- 易并联使用 — Easy Paralleling

电路结构 Circuit Configuration

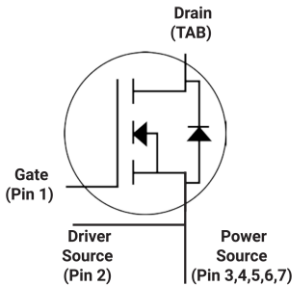


图 1. 电路结构

Fig. 1 Circuit configuration

器件外形 Device Appearance

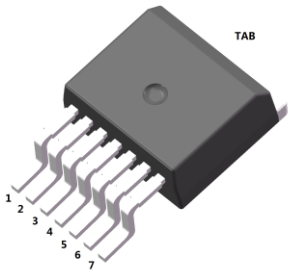


图 2. 模块外形

Fig. 2 Device appearance

最大额定值 Maximum Ratings

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	数值 Value	单位 Unit
V_{DSS}	漏源极电压 Drain-source voltage	V_{GS}=0V, T_C≥25℃	1200	V
V_{GSS}	栅源电压 Gate-source voltage	T_C=25℃	-8/+23	V
V_{GSop}	栅源电压 Gate-source voltage		-4/+18	V
I_D	持续正向电流，由 $T_{vj\,max}$ 限制 Continuous forward current, limited by $T_{vj\,max}$	T_C=25℃, $T_{vj\,max}$=175℃	82	A
		T_C=100℃, $T_{vj\,max}$=175℃	63	A
I_{DM}	最大重复正向电流，由 $T_{vj\,max}$ 限制 Maximum repetitive forward current, limited by $T_{vj\,max}$	t_P=1ms	164	A
$T_{vj\,max}$	最大允许结温 Max. Junction temperature		175	°C
$T_{vj(op)}$	工作结温 Operation junction temperature		-55...+175	°C

T_{stg}	存储温度 Storage temperature range		-55...+150	°C

电特性值 Electrical Characteristics

除非特别声明，否则 T_{vj}= 25 °C　　T_{vj}= 25 °C unless otherwise stated

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
I_{DSS}	零栅压漏极电流 Zero gate voltage drain current	V_{GS} = 0V,V_{DS} = V_{DSS}			50	μA
I_{GSS}	栅极漏电流 Gate leakage current	V_{GS} = V_{GSS}, V_{DS} = 0V			250	nA
$V_{GS(th)}$ (*1)	栅极-源极阈值电压 Gate threshold voltage	I_D = 10 mA, V_{GS} = V_{DS}	2.1	2.8	3.5	V
$R_{DS(on)}$	漏极-源极通态电阻 Drain-source on-state resistance	V_{GS} =18V, I_D =52A		25	32	mΩ
		V_{GS} =18V, I_D = 52A,T_{vj} = 175 °C		45		mΩ
		V_{GS} =15V, I_D =52A		32	41	mΩ
		V_{GS} =15V, I_D = 52A,T_{vj} = 175 °C		50		mΩ
g_{fs}	跨导 Forward transconductance	V_{DS} =20V, I_D = 52A		29		S
C_{iss}	输入电容 Input capacitance	V_{DS} = 1000V, V_{GS} = 0V, f = 100kHz, V_{AC} = 30mV		2953		pF
C_{oss}	输出电容 Output capacitance			136		pF
C_{rss}	反向传输电容 Reverse transfer capacitance			7		pF
E_{oss}	电容存储能量 C_{oss} Stored Energy			68		μJ
R_{Gint}	内部栅极电阻 Internal gate resistor	V_{GS} =0V		5		Ω
Q_{gs}	栅源电荷 Gate to source charge	I_D =52A, V_{DS} = 800V, V_{GS} = -4/+18V		32		nC
Q_{gd}	栅漏电荷 Gate to drain charge			65		nC
Q_g	总栅极电荷 Total gate charge			116		nC
V_{SD}	二极管正向电压 Diode forward voltage	I_{SD} =52A, V_{GS} = -4V		4.9		V
		I_{SD} =52A, V_{GS} = -4V, T_{vj} = 175 °C		4.5		V

注意： 1.(*1)表示做过预处理后的测试值

Note: 1.(*1)Indicates $V_{GS(th)}$ is pre-processed).

电特性值 Electrical Characteristics

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions		最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$t_{d(off)}$	关断延迟时间 Turn-off delay time	I_D =33A, V_{DS} = 800V, V_{GS} = -4/+15V, $R_{G(OFF)}$ =0.0Ω, dv/dt =67860V/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		26		ns
			T_{vj}= 175 °C		28		
t_f	下降时间 Fall time		T_{vj}= 25 °C		15		ns
			T_{vj}= 175 °C		18		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj}= 25 °C		108		uJ
			T_{vj}= 175 °C		130		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	I_D =33A, V_{DS} = 800V, V_{GS} = -4/+15V, $R_{G(ON)}$ =3.9Ω, di/dt =1500A/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		11		ns
			T_{vj}= 175 °C		13		
t_r	上升时间 Rise time		T_{vj}= 25 °C		12		ns
			T_{vj}= 175 °C		12		
E_{ON}	开通损耗 Turn-on energy loss		T_{vj}= 25 °C		312		uJ
			T_{vj}= 175 °C		334		
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_D =33A, V_{DS} = 800V, - di_{SD}/dt = 1500A/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		143		nC
			T_{vj}= 175 °C		220		
I_{rr}	二极管反向恢复电流 Diode reverse recovery current		T_{vj}= 25 °C		7		A
			T_{vj}= 175 °C		10		

电特性值 Electrical Characteristics

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions		最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$t_{d(off)}$	关断延迟时间 Turn-off delay time	I_D =33A, V_{DS} = 800V, V_{GS} = -4/+18V, $R_{G(OFF)}$ =0.0Ω, dv/dt =75400V/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		28		ns
			T_{vj}= 175 °C		30		
t_f	下降时间 Fall time		T_{vj}= 25 °C		15		ns
			T_{vj}= 175 °C		17		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj}= 25 °C		120		uJ
			T_{vj}= 175 °C		144		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	I_D =33A, V_{DS} = 800V, V_{GS} = -4/+18V, $R_{G(ON)}$ =5.1Ω, di/dt =1500A/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		12		ns
			T_{vj}= 175 °C		13		
t_r	上升时间 Rise time		T_{vj}= 25 °C		12		ns
			T_{vj}= 175 °C		12		
E_{ON}	开通损耗 Turn-on energy loss		T_{vj}= 25 °C		347		uJ
			T_{vj}= 175 °C		371		
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_D =33A, V_{DS} = 800V, - di_{SD}/dt =1500A/μs (T_{vj}= 175 °C)	T_{vj}= 25 °C		143		nC
			T_{vj}= 175 °C		220		
I_{rr}	二极管反向恢复电流 Diode reverse recovery current		T_{vj}= 25 °C		7		A
			T_{vj}= 175 °C		10		

热学特性 Thermal Characristics

符号 (Symbol)	参数名称 (Parameter)	条件 (Test Conditions)	最小值 (Min)	典型值 (Typ)	最大值 (Max)	单位 (Unit)
$R_{\theta VJ-C}$	结到壳热阻 Thermal resistance, junction – case	T_C = 25°C, T_{vj} = 175°C		0.34		K/W

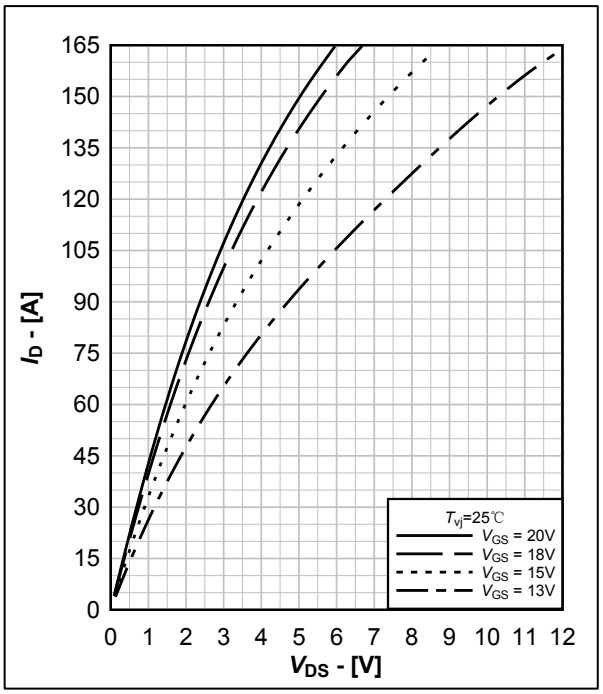


图 3. 输出特性典型曲线, I_D= f (V_{DS}), T_{vj} = 25 °C

Fig.3 Typical output characteristics, I_D= f (V_{DS}), T_{vj} = 25 °C

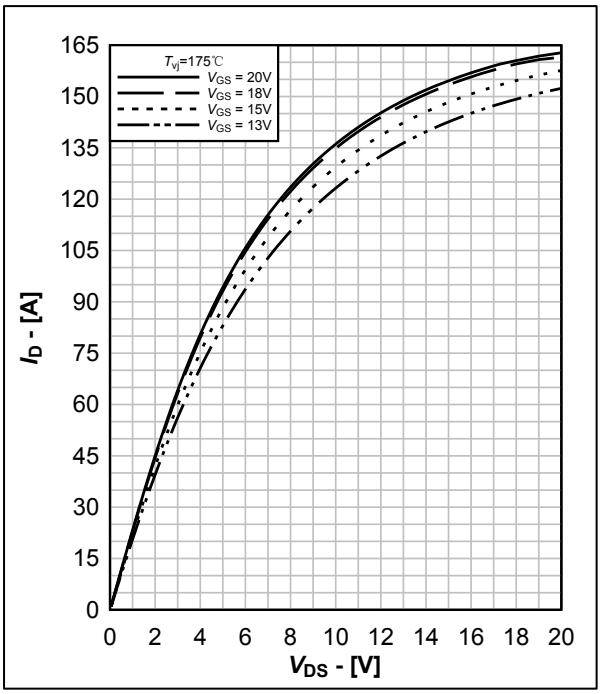


图 4. 输出特性典型曲线, I_D= f (V_{DS}), T_{vj} = 175 °C

Fig.4 Typical output characteristics, I_D= f (V_{DS}), T_{vj} = 175 °C

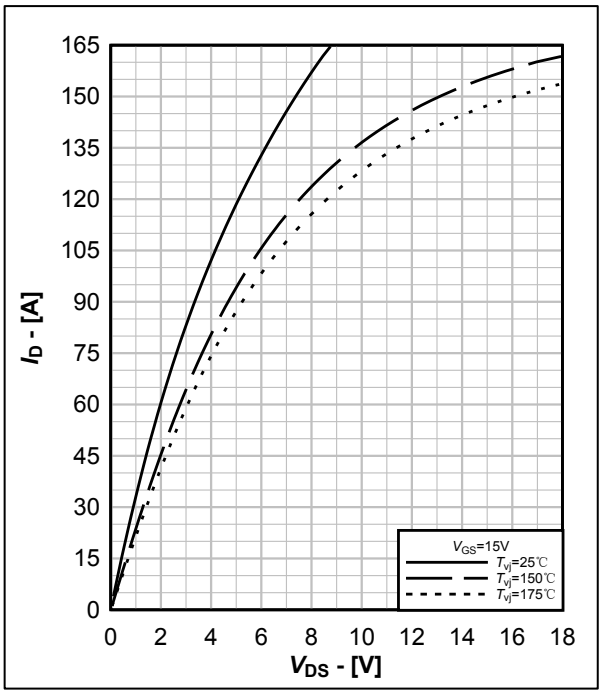


图 5. 输出特性典型曲线, I_D= f (V_{DS})

Fig.5 Typical output characteristics, I_D= f (V_{DS})

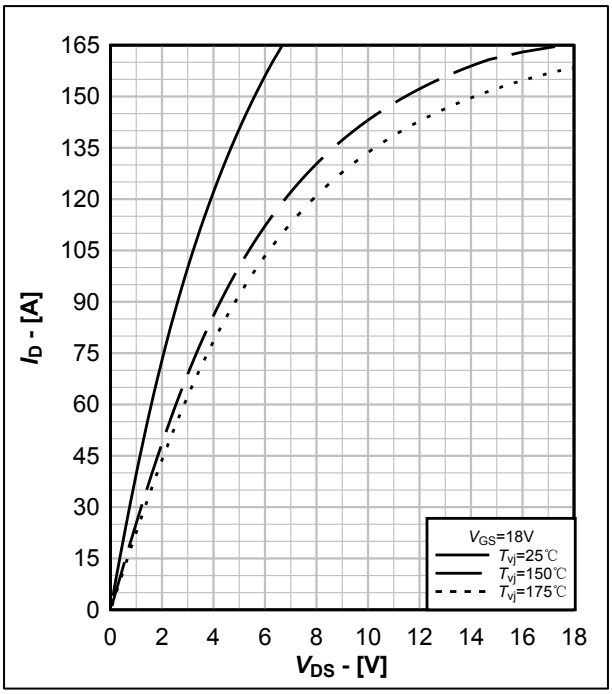


图 6. 输出特性典型曲线, I_D= f (V_{DS})

Fig.6 Typical output characteristics, I_D= f (V_{DS})

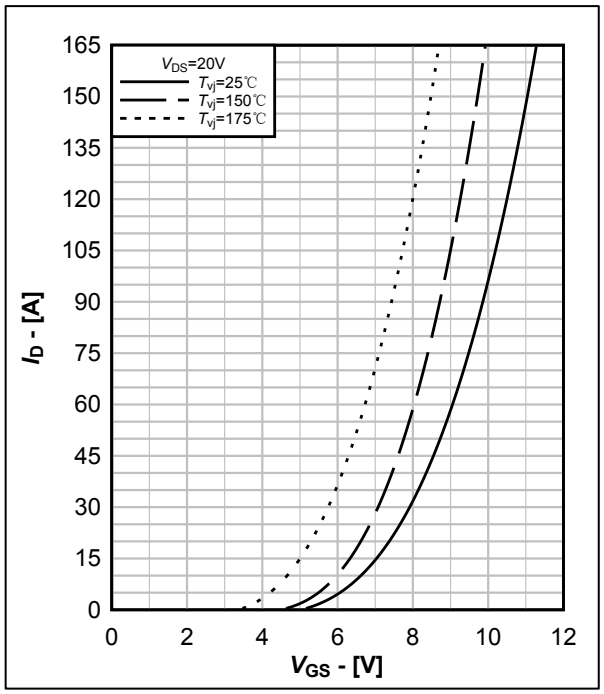


图 7.传输特性典型曲线,I_D= f (V_{GS})

Fig.7 Typical transfer characteristics, I_D= f (V_{GS})

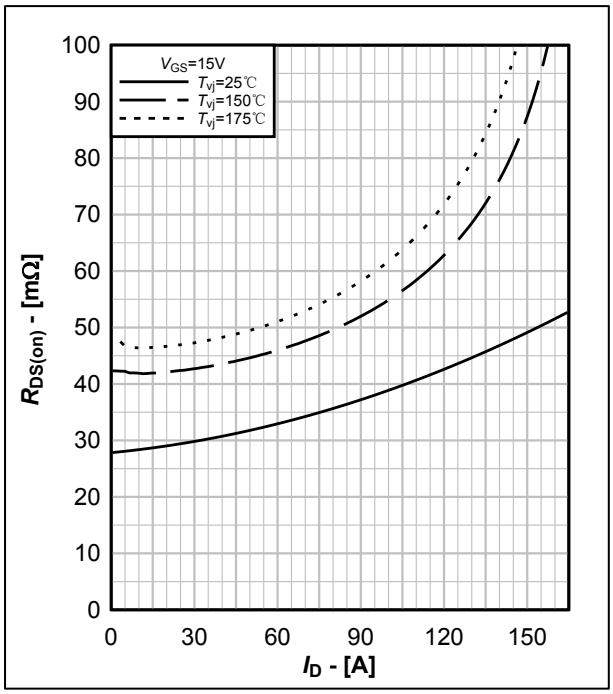


图 8. 导通电阻典型曲线, $R_{DS(on)}$ = f (I_D)

Fig.8 Typical On-Resistance characteristics, $R_{DS(on)}$ = f (I_D)

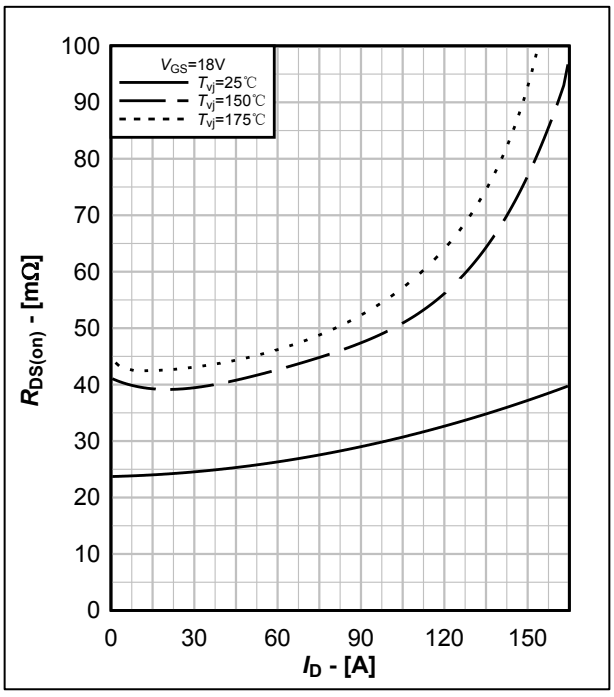


图 9. 导通电阻典型曲线, $R_{DS(on)}$ = f (I_D)

Fig.9 Typical On-Resistance characteristics, $R_{DS(on)}$ = f (I_D)

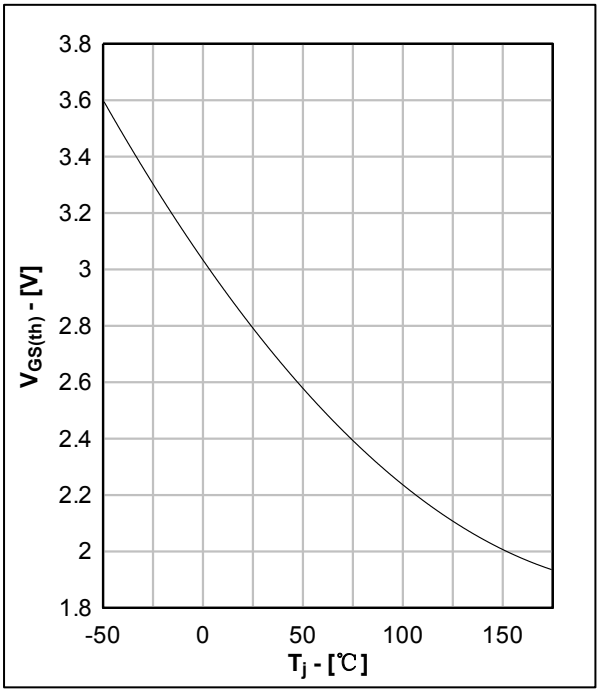


图 10. 阈值电压典型曲线, $V_{GS(th)}$ = f (T_j)

Fig.10 Typical $V_{GS(th)}$ characteristics, $V_{GS(th)}$ = f (T_j)

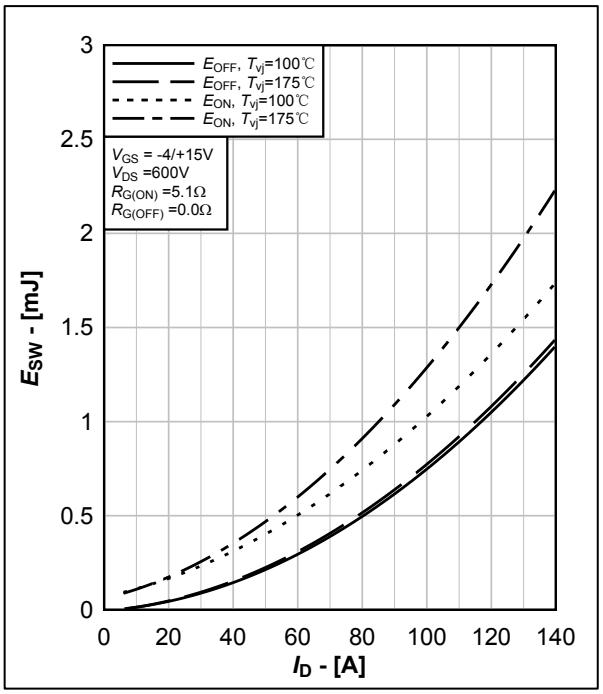


图 11. MOSFET 开关损耗典型曲线, E_{off}= f (I_D), E_{on}= f (I_D)

Fig.12 Typical MOSFET switching energy, E_{off}= f (I_D), E_{on}= f (I_D)

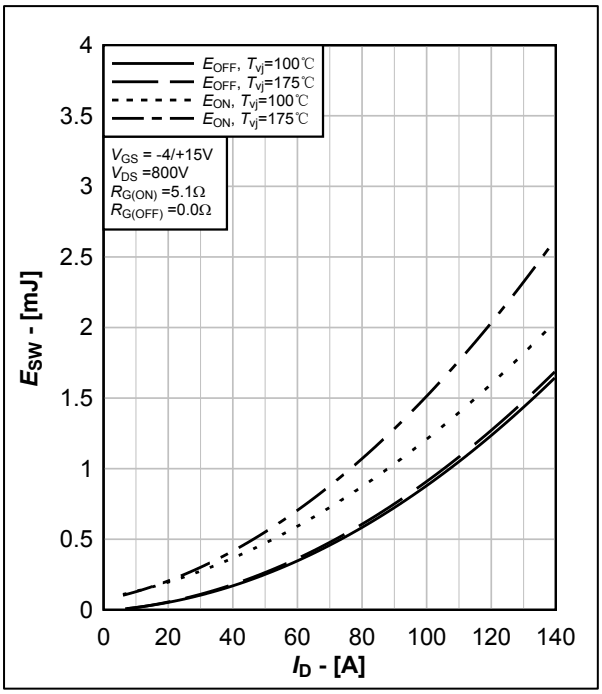


图 12. MOSFET 开关损耗典型曲线, E_{off}= f (I_D), E_{on}= f (I_D)

Fig.12 Typical MOSFET switching energy, E_{off}= f (I_D), E_{on}= f (I_D)

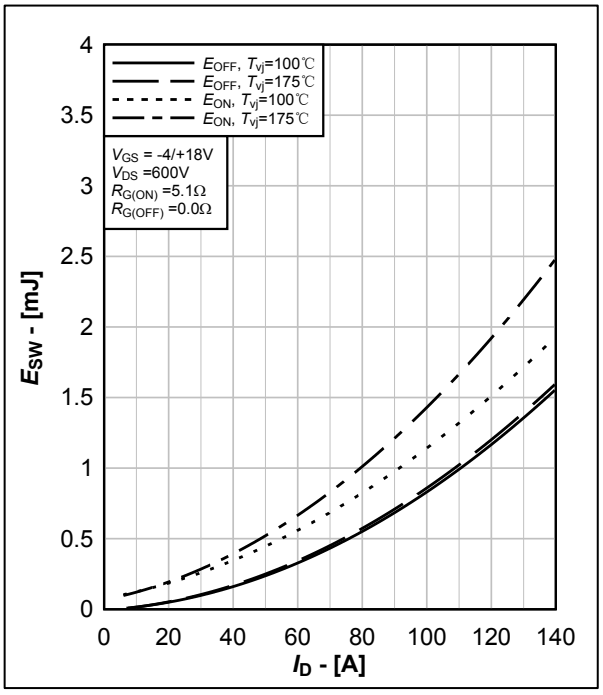


图 13. MOSFET 开关损耗典型曲线, E_{off}= f (I_D), E_{on}= f (I_D)

Fig.13 Typical MOSFET switching energy, E_{off}= f (I_D), E_{on}= f (I_D)

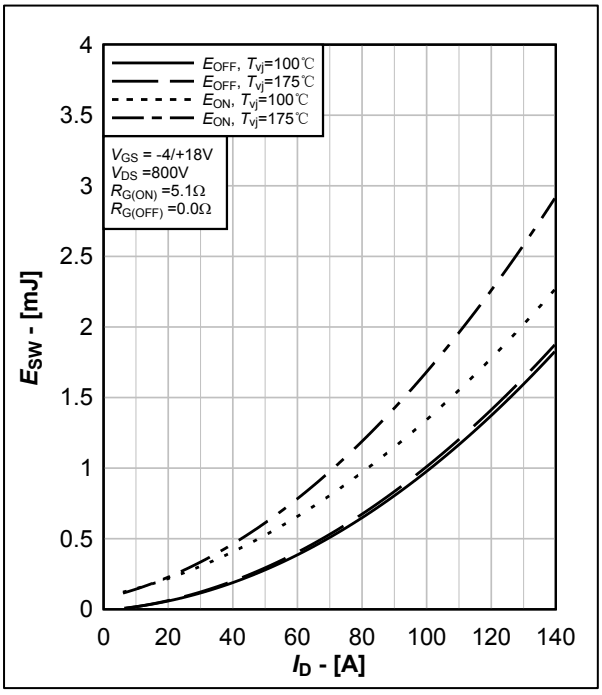


图 14. MOSFET 开关损耗典型曲线, E_{off}= f (I_D), E_{on}= f (I_D)

Fig.14 Typical MOSFET switching energy, E_{off}= f (I_D), E_{on}= f (I_D)

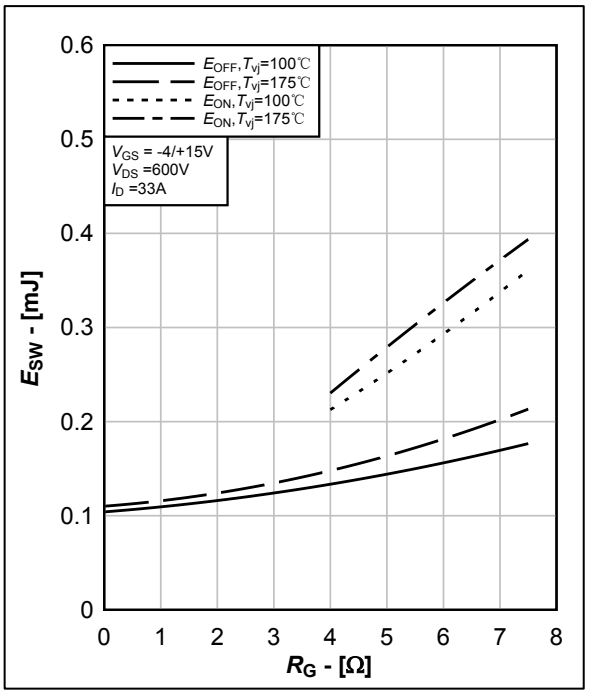


图 15. MOSFET 开关损耗典型曲线, E_{on}= f (R_G), E_{off}= f (R_G)

Fig.15 Typical MOSFET switching energy, E_{on}= f(R_G), E_{off}= f (R_G)

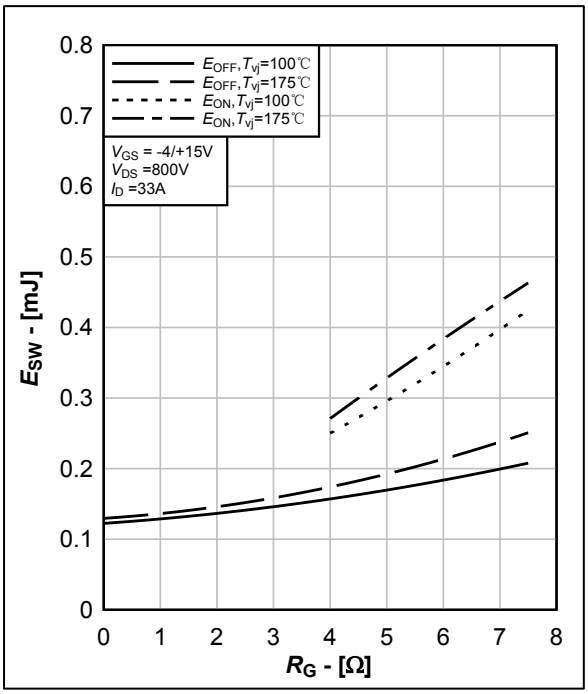


图 16. MOSFET 开关损耗典型曲线, E_{on}= f (R_G), E_{off}= f (R_G)

Fig.16 Typical MOSFET switching energy, E_{on}= f(R_G), E_{off}= f (R_G)

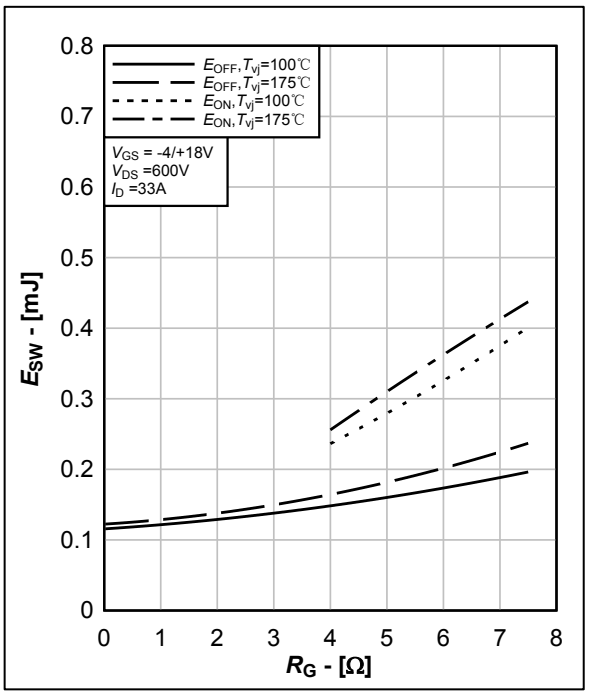


图 17. MOSFET 开关损耗典型曲线, E_{on}= f (R_G), E_{off}= f (R_G)

Fig.17 Typical MOSFET switching energy, E_{on}= f(R_G), E_{off}= f (R_G)

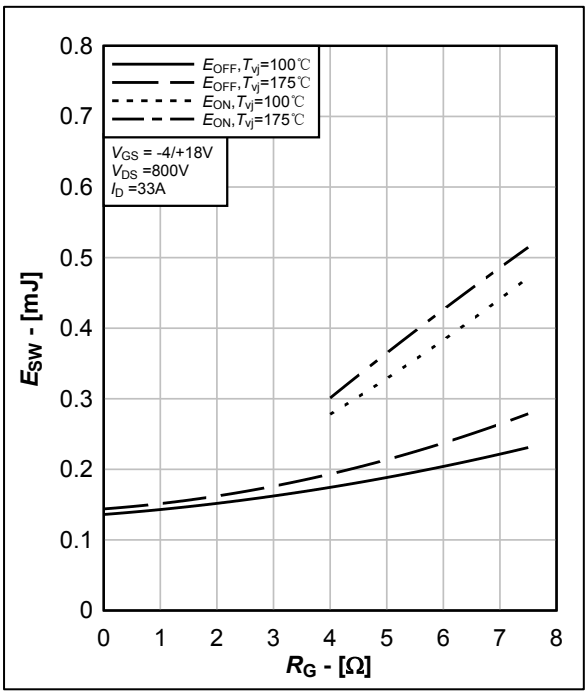


图 18. MOSFET 开关损耗典型曲线, E_{on}= f (R_G), E_{off}= f (R_G)

Fig.18 Typical MOSFET switching energy, E_{on}= f(R_G), E_{off}= f (R_G)

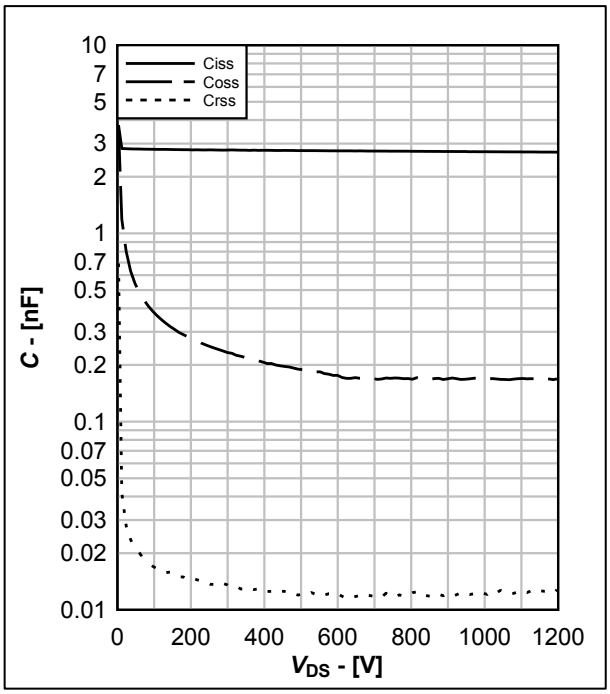


图 19. 电容特性典型曲线, C= f (V_{DS})

Fig.19 Typical capacity characteristic, C= f (V_{DS})

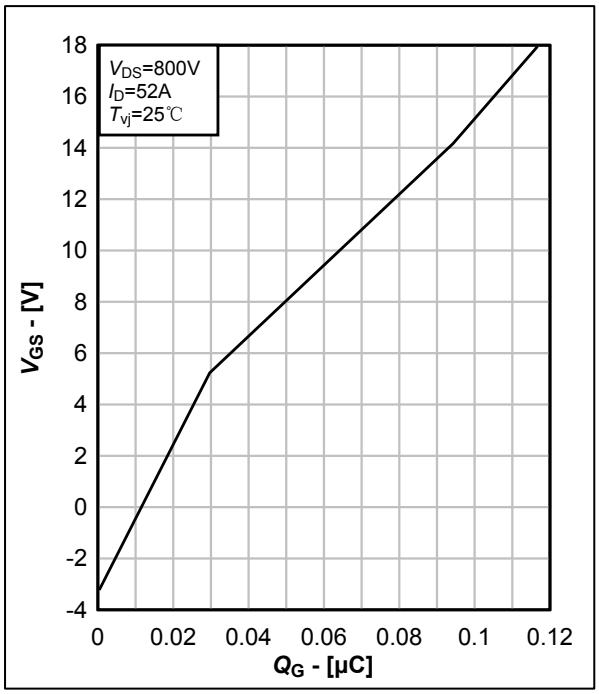


图 20. 栅极电荷特性典型曲线, V_{GS} = f (Q_G)

Fig.20 Typical gate charge characteristic, V_{GS}= f (Q_G)

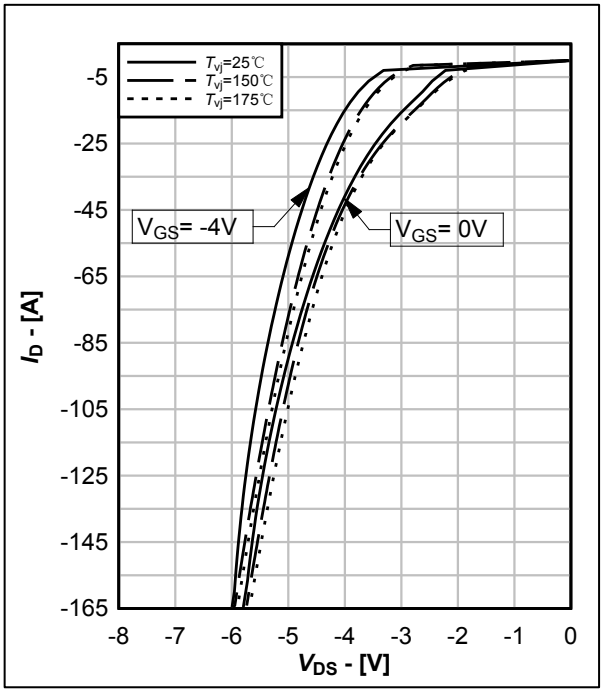


图 21. 体二极管及第三象限输出特性典型曲线, I_D = f (V_{DS})

Fig.21 Typical body diode output and 3rd quadrant characteristic, I_D = f (V_{DS})

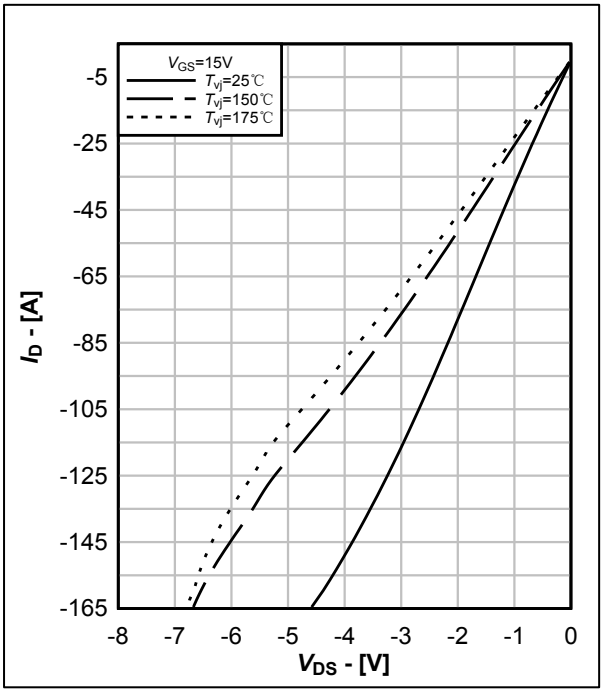


图 22. 体二极管及第三象限输出特性典型曲线, I_D = f (V_{DS})

Fig.22 Typical body diode output and 3rd quadrant characteristic, I_D = f (V_{DS})

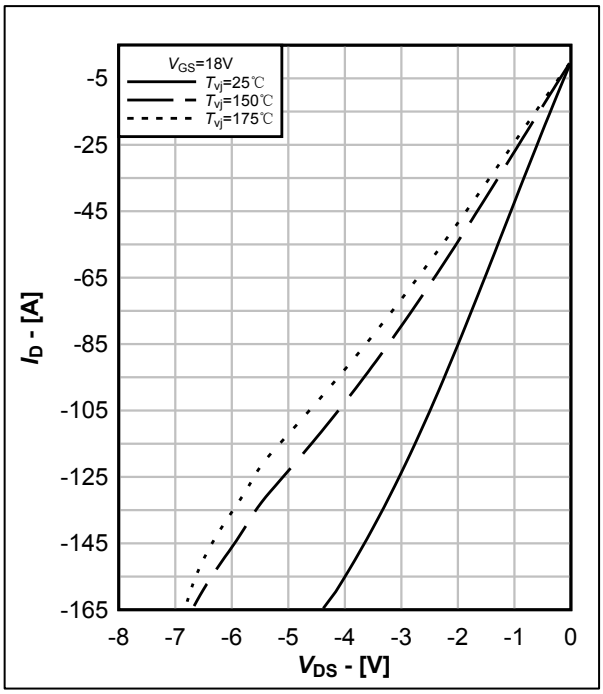


图 23. 导通电阻典型曲线, $R_{DS(on)}$ = f (T_{vj})

Fig.23 Typical On-Resistance characteristics, $R_{DS(on)}$ = f (T_{vj})

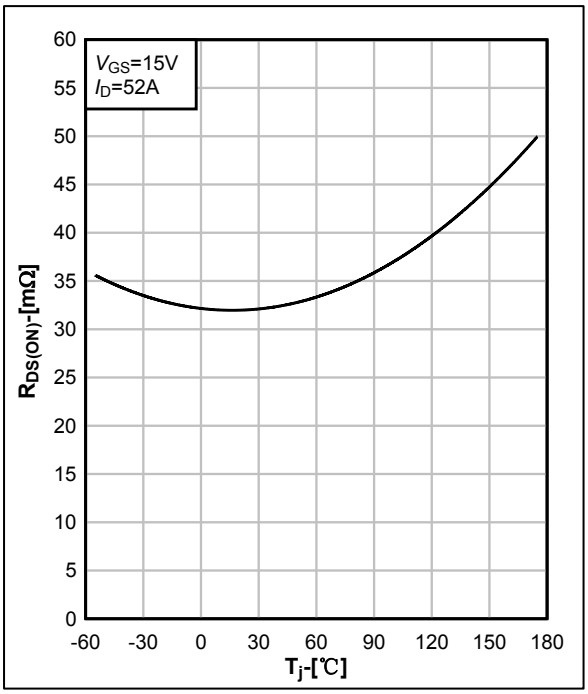


图 24. 导通电阻典型曲线, $R_{DS(on)}$ = f (T_j)

Fig.24 Typical On-Resistance characteristics, $R_{DS(on)}$ = f (T_j)

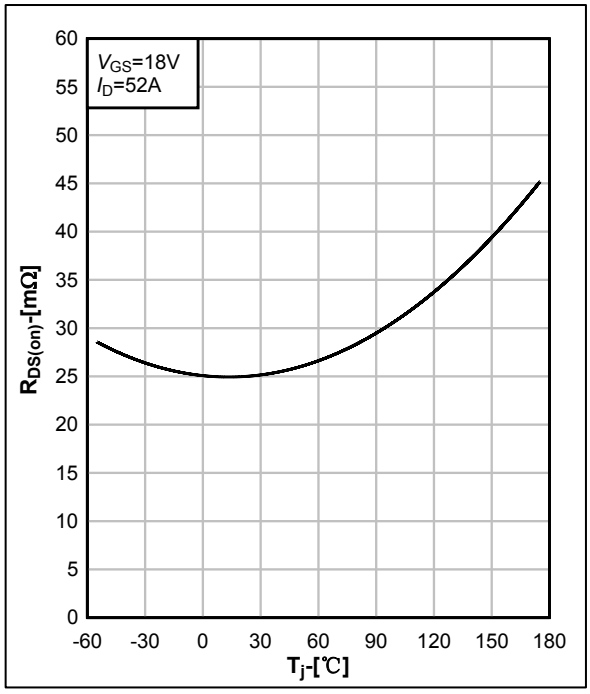


图 25. 导通电阻典型曲线, $R_{DS(on)}$ = f (T_j)

Fig.25 Typical On-Resistance characteristics, $R_{DS(on)}$ = f (T_j)

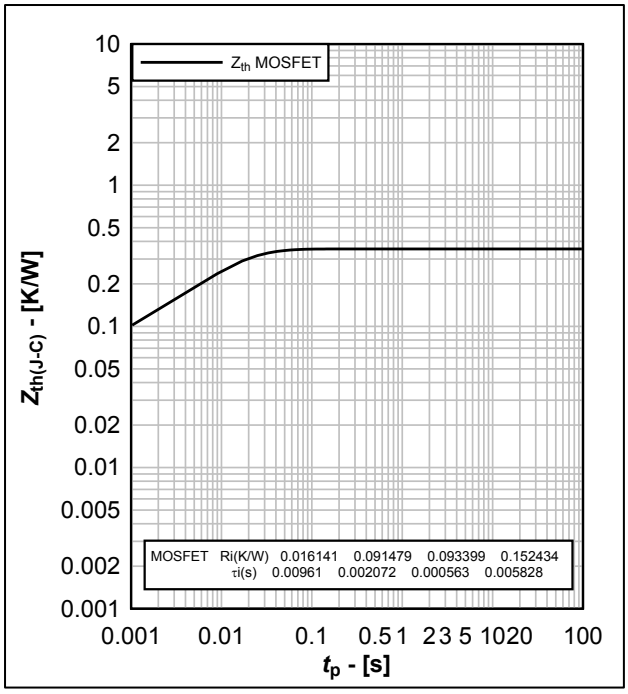


图 26. 瞬态热阻抗曲线, $Z_{th(J-C)}$ = f (t_p)

Fig.26 Transient thermal impedance, $Z_{th(J-C)}$ = f (t_p)

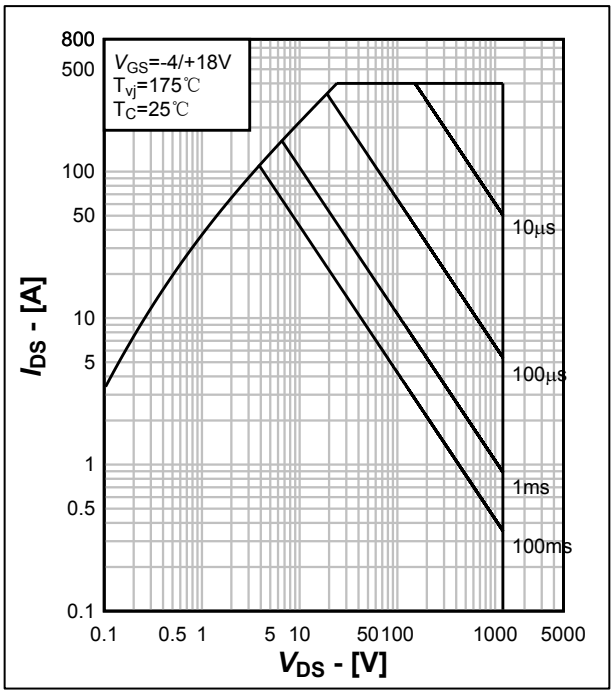
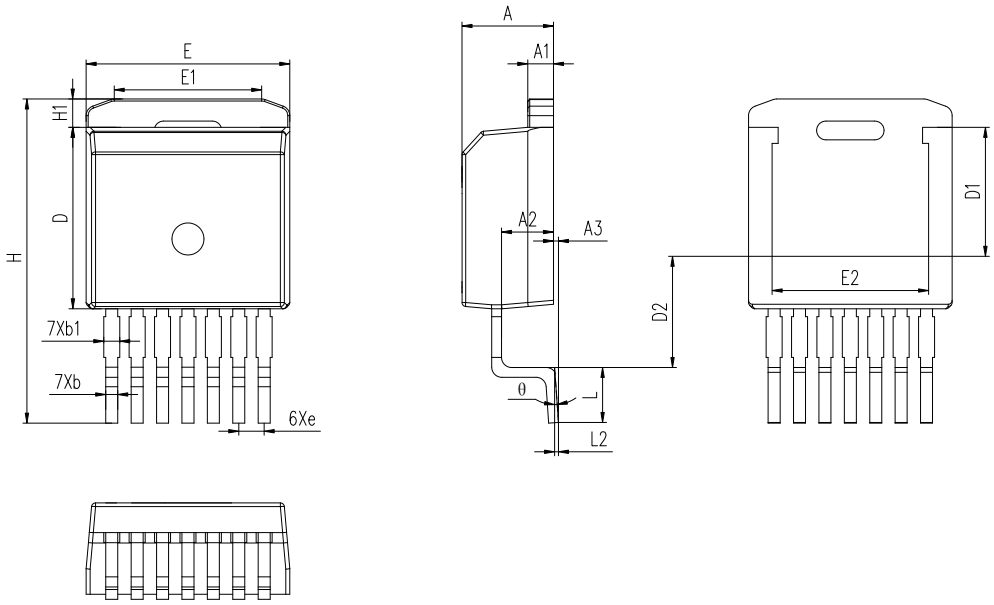


图 27. MOSFET 安全工作区, I_D = f (V_{DS})

Fig.27 MOSFET Safe Opreating Area, I_D = f (V_{DS})



SYMBOL	mm		
	MIN	NOM	MAX
A	4.30	4.43	4.56
A1	1.20	1.30	1.40
A2	2.45	2.60	2.75
A3	0.00	0.13	0.25
b	0.50	0.60	0.70
b1	0.60	0.70	0.90
c	0.45	0.50	0.60
D	8.93	9.08	9.23
D1	6.30	6.45	6.60
D2	5.18 REF		
e	1.27 BSC		
E	10.08	10.18	10.28
E1	7.00 REF		
E2	7.90	8.30	8.70
H	14.53	15.03	15.53
H1	0.98	1.20	1.42
L	1.90	2.20	2.50
L2	0.25 BSC		
θ	0°	3°	7°

图 28. 封装尺寸

Fig. 28 Package Dimensions

株洲中车时代半导体有限公司

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