

## General Description

### 概述

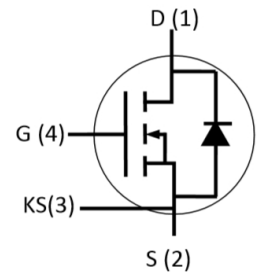
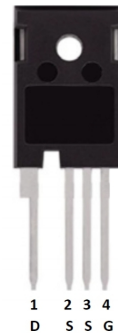
Specifically designed for Automotive applications, this SiC Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per unit area.

本产品是一款专为汽车应用设计的碳化硅功率MOSFET产品，采用了先进的工艺技术，产品的单位面积导通电阻非常低。

## Features

### 特点

- High Speed Switching with Low Capacitances  
开关速度快，寄生电容小
- High Blocking Voltage with Low  $R_{DS(on)}$   
阻断电压高，开通电阻低
- 100% avalanche tested  
100%通过雪崩测试
- Halogen Free and RoHS Compliant  
无卤元素，符合 RoHS



## Typical Applications

### 典型应用

- EV Charging  
EV 充电
- DC-AC Inverters  
DC-AC 转换器
- High Voltage DC/DC Converters  
高压 DC/DC 变压器
- Power Factor Correction Modules  
功率因素校正模块

## Ordering Information

### 订货信息

Type 型号	BVDSS[V] 漏极-源极电压	$R_{DS(on)}$ [m $\Omega$ ] 导通电阻	Tjmax[°C] 最高结温	Marking 标记	Packing 封装外形
BSK040S120	1200	40	175	BSK040S120	TO247-4



## Maximum Rated Values

### 最大额定参数

Parameter 参数	Symbol 符号	Value 数值	Unit 单位
Drain-Source Voltage, $T_j \geq 25^\circ\text{C}$ 漏-源电压, $T_j \geq 25^\circ\text{C}$	$V_{\text{DSS}}$	1200	V
Drain Current(continuous)at $T_c=25^\circ\text{C}$ 常温下漏极电流(持续)	$I_{\text{D}}$	60	A
Drain Current(continuous)at $T_c=100^\circ\text{C}$ $T_c=100^\circ\text{C}$ 下漏极电流(持续)		40	
Pulsed Drain current, tp limited by $T_j$ max 集电极脉冲电流, 脉宽时间受 $T_j$ max 限制	$I_{\text{D(pulse)}}$	100	
Gate-Source Voltage 栅极-源极电压	$V_{\text{GS MAX}}$	-10/+22	V
Gate-Source Voltage (Recommended operational values) 栅极-源极电压(推荐工作电压)	$V_{\text{GS}}$	-5/+18	V
Power Dissipation $T_c = 25^\circ\text{C}$ 常温耗散功率	$P_{\text{D}}$	312	W
Storage Temperature Range 储存温度范围	$T_{\text{J.Tstg}}$	-55 to +175	$^\circ\text{C}$
Solder Temperature, 1.6mm case from for10s 焊接温度	$T_{\text{ST}}$	260	
Operating junction temperature Range 工作结温	$T_{\text{J}}$	-55 to +175	
Mounting Torque 安装力矩	$M_{\text{d}}$	1 8.8	Nm lbf-in

**Caution:** These values must not be exceeded under any conditions.

注意：任何条件下都不能超出上述值。

## Thermal Resistance

### 热阻

Parameter 参数	Symbol 符号	Value 值	Unit 单位
Thermal Resistance, Junction to Case, Max. 结-管壳热阻	$R_{\theta\text{JC}}$	0.48	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient, Max. 结-环境热阻	$R_{\theta\text{JA}}$	38	



**Electrical Characteristic at  $T_j = 25^{\circ}\text{C}$  (unless otherwise specified)**

**$T_j=25^{\circ}\text{C}$ 时电学特性（除非特别声明）**

Parameter 参数	Symbol 符号	Conditions 条件	Value 值			Unit 单位
			Min. 最小 值	Typ. 典型 值	Max. 最大 值	

**Static Characteristic**

**静态特性**

Drain to Source Breakdown Voltage 漏极-源极击穿电压	$BV_{DSS}$	$V_{GS}=0V, I_D=100\mu A$ $T_j=25^{\circ}\text{C}$	1200	-	-	V
Zero Gate Voltage Drain Current 栅源-漏极漏电流	$I_{DSS}$	$V_{DS}=1200V, V_{GS}=0V,$ $T_j=25^{\circ}\text{C}$	-	0.4	100	$\mu A$
Gate to Body Leakage Current 栅极-源极漏电流	$I_{GSS}$	$V_{GS}=18V, V_{DS}=0V$	-	-	200	nA
Static Drain-source On Resistance 漏极-源极开通电阻	$R_{DS(on)}$	$V_{GS}=18V, I_D=33A,$ $T_j=25^{\circ}\text{C}$	-	40	60	m $\Omega$
		$V_{GS}=18V, I_D=33A,$ $T_j=175^{\circ}\text{C}$	-	68	-	
Gate Threshold Voltage 栅极-源极阈值电压	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_{DS}=10mA$ $T_j=25^{\circ}\text{C}$	2.0	3.2	4.0	V
		$V_{DS}=V_{GS}, I_{DS}=10mA$ $T_j=175^{\circ}\text{C}$	-	2.3	-	
Gate Resistance 栅极电阻	$R_G$	$f=1MHz, V_{AC}=25mV$	-	2.5	-	$\Omega$

**Dynamic Characteristic**

**动态特性**

Input Capacitance 输入电容	$C_{iss}$	$V_{DD}=1000V,$ $f=1MHz, V_{GS}=0V,$ $V_{AC}=25mV$	-	3009	-	pF
Output Capacitance 输出电容	$C_{oss}$		-	182	-	
Reverse Transfer Capacitance 反向传输电容	$C_{rss}$		-	25	-	
Total Gate Charge 栅极总电荷	$Q_{g(tot)}$	$V_{DD}=800V,$ $I_D=40A, V_{GS}=-5/20V$	-	150	-	nC
Gate-source Charge 栅-源电荷	$Q_{gs}$		-	60	-	
Gate-Drain Charge 栅-漏电荷	$Q_{gd}$		-	30	-	



Switching Characteristic at  $T_j=25^\circ\text{C}$  (Inductive Load)

$T_j=25^\circ\text{C}$ 时开关特性（电感负载）

Parameter 参数	Symbol 符号	Conditions 条件	Value 值			Unit 单位
			Min. 最小 值	Typ. 典型 值	Max. 最大 值	
MOSFET Characteristic MOSFET 特性						
Turn-on delay time 开通延迟时间	t <sub>d(on)</sub>	V <sub>DS</sub> =800V, V <sub>GS</sub> =-5/20V, I <sub>D</sub> =40A, R <sub>G(ext)</sub> =5Ω, R <sub>L</sub> =20Ω	-	22	-	ns
Rise time 上升时间	t <sub>r</sub>		-	46	-	
Turn-off delay time 关断延迟时间	t <sub>d(off)</sub>		-	40	-	
Fall time 下降时间	t <sub>f</sub>		-	52	-	
Turn-on Switching Energy 开通损耗	E <sub>on</sub>	V <sub>DS</sub> =800V, V <sub>GS</sub> =-5/20V, I <sub>D</sub> =40A, R <sub>G(ext)</sub> =5Ω, L=300μH	-	1.3	-	mJ
Turn-off Switching Energy 关断损耗	E <sub>off</sub>		-	0.8	-	

**SOURCE-DRAIN DIODE CHARACTERISTICS**

源极-漏极二极管特性

Source to Drain Diode Forward Voltage 源极-漏极正向电压	$V_{SD}$	$V_{GS}=-5\text{V},$ $I_{SD}=20\text{A},$ $T_j=25^\circ\text{C}$	-	3.4	-	V
		$V_{GS}=-5\text{V},$ $I_{SD}=20\text{A},$ $T_j=150^\circ\text{C}$	-	3.1	-	
Continuous Diode Forward Current 正向电流	$I_{SD}$	$T_C=25^\circ\text{C}$	-	-	60	A
Reverse recovery time 反向恢复时间	$t_{rr}$	$T_j=25^\circ\text{C},$ $V_{GS}=-5\text{V}$ $V_R=800\text{V},$ $I_{SD}=40\text{A},$ $diF/dt=1200\text{A}/\mu\text{s}$	-	50	-	ns
Recovered charge 恢复电荷	$Q_{rr}$		-	140	-	$\mu\text{C}$
Peak reverse recovery current 反向峰值电流	$I_{rrm}$		-	5	-	A

Notes

a: Repetitive Rating : Pulse width limited by maximum junction temperature

b: Pulse Test : Pulse width  $\leq 380\mu\text{s}$

c: Essentially independent of operating temperature

注:

a: 重复范围: 脉冲宽度受限于最大结温

b: 脉冲测试: 脉冲宽度 $\leq 380\mu\text{s}$

c: 本质上与工作温度无关

## Electrical characteristics diagram 特性曲线

Figure 1. Output Characteristics  $T_J = -55^{\circ}\text{C}$

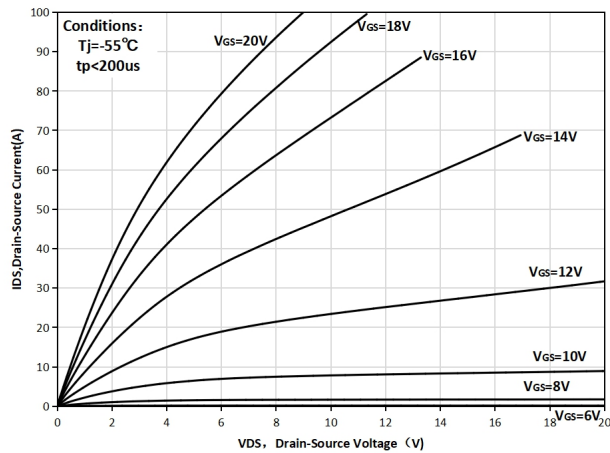


Figure 2. Output Characteristics  $T_J = 25^{\circ}\text{C}$

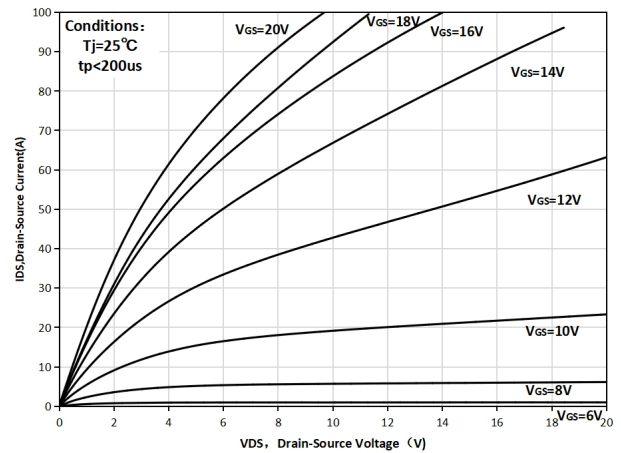


Figure 3. Output Characteristics  $T_J = 175^{\circ}\text{C}$

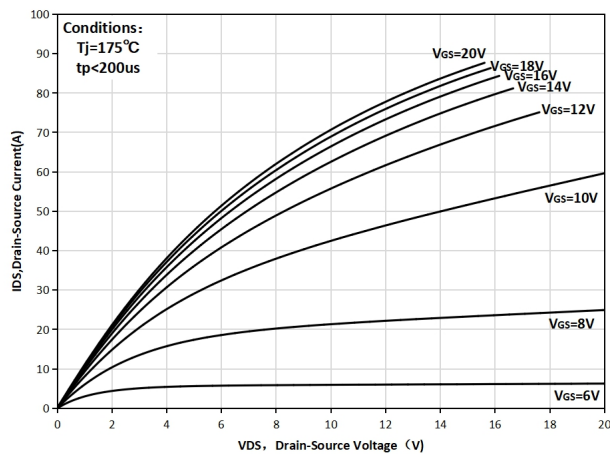


Figure 4. On-Resistance For Various Gate Voltage

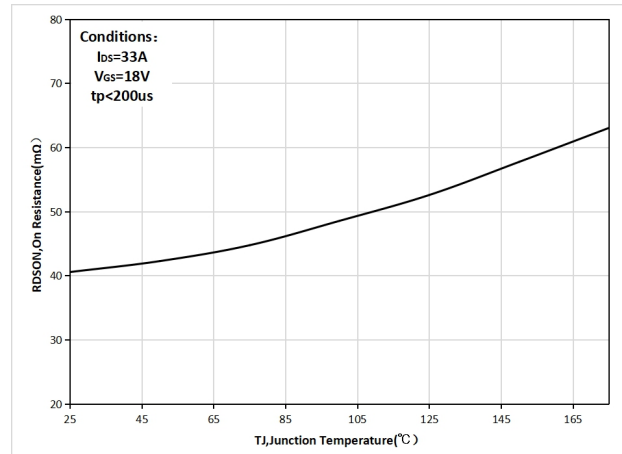


Figure 5. Transfer Characteristic  
for Various Junction Temperatures

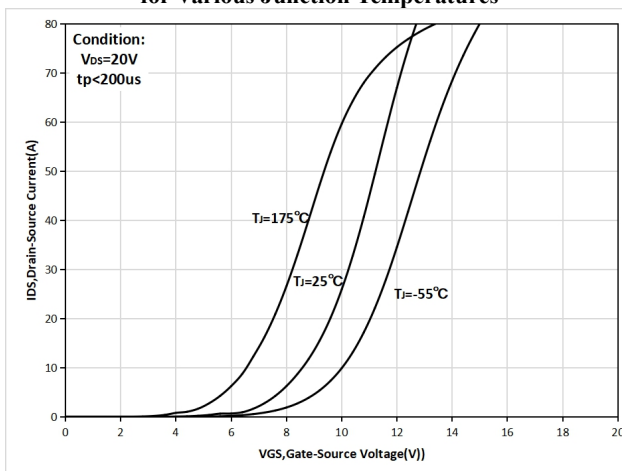


Figure 6. Threshold Voltage vs. Temperature

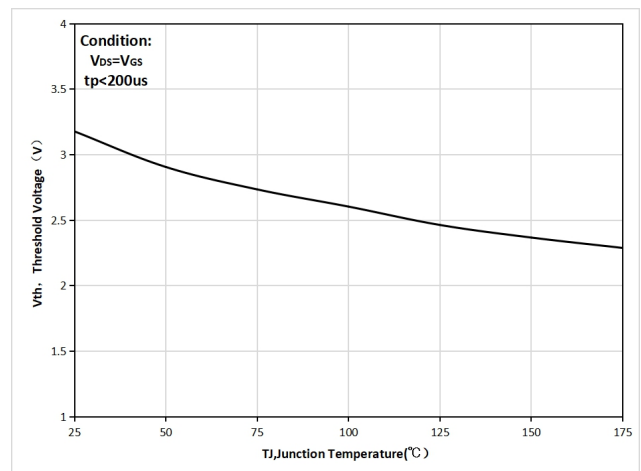


Figure 7. Body Diode Characteristics at -55°C

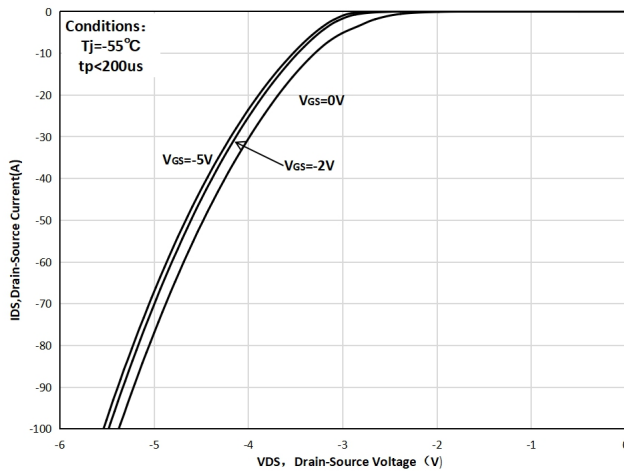


Figure 8. Body Diode Characteristics at 25°C

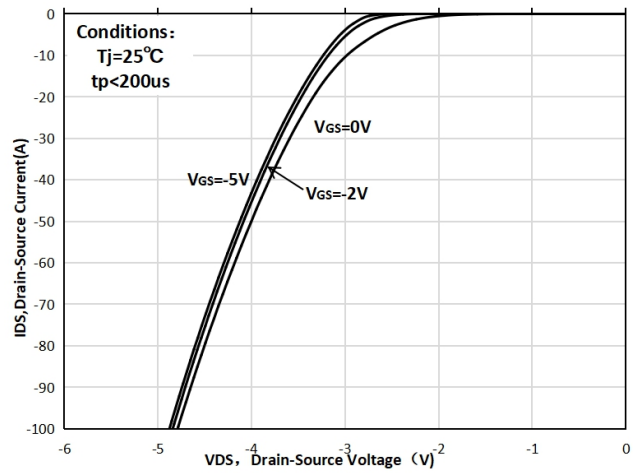


Figure 9. Body Diode Characteristics at 175°C

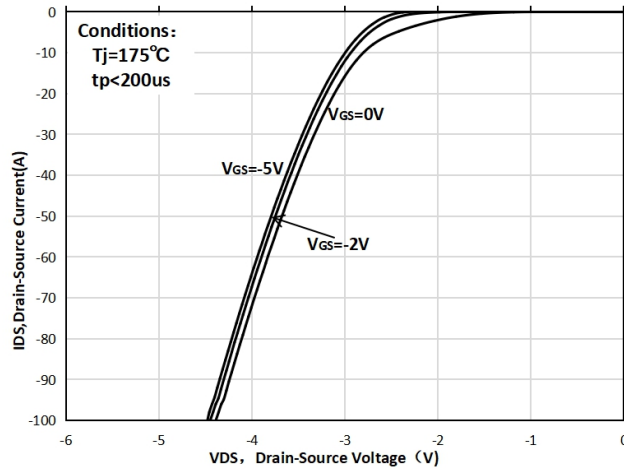


Figure 10. Capacitances vs. Drain-Source Voltage

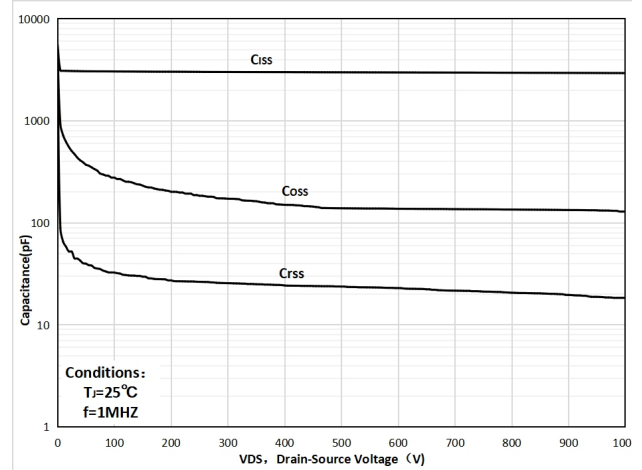


Figure 11. Gate Charge Characteristics

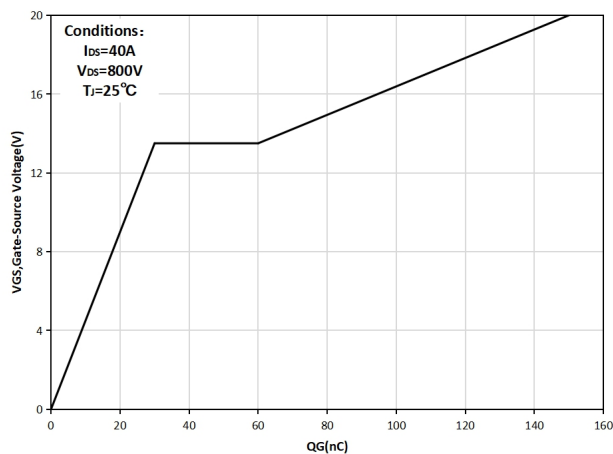
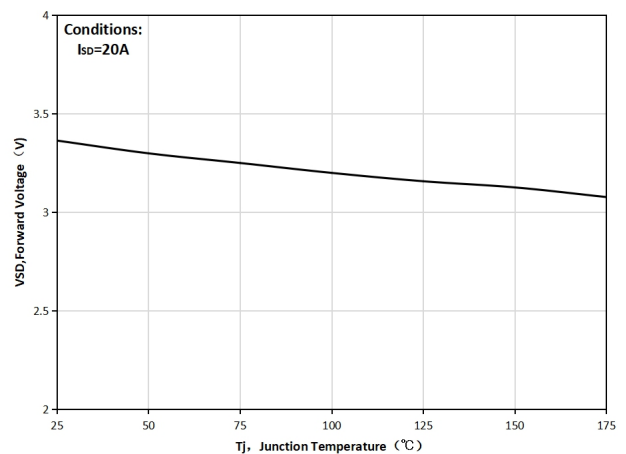
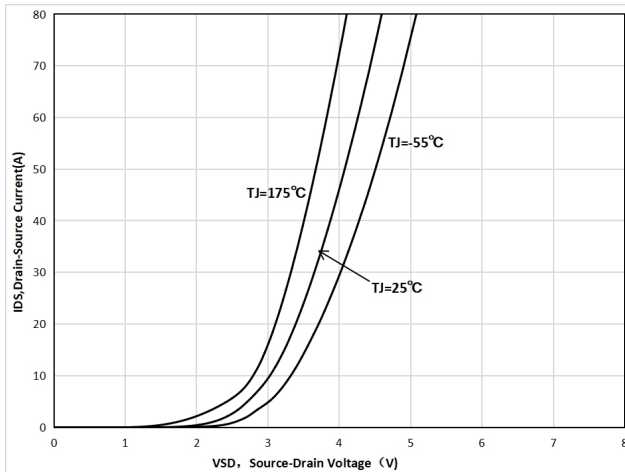


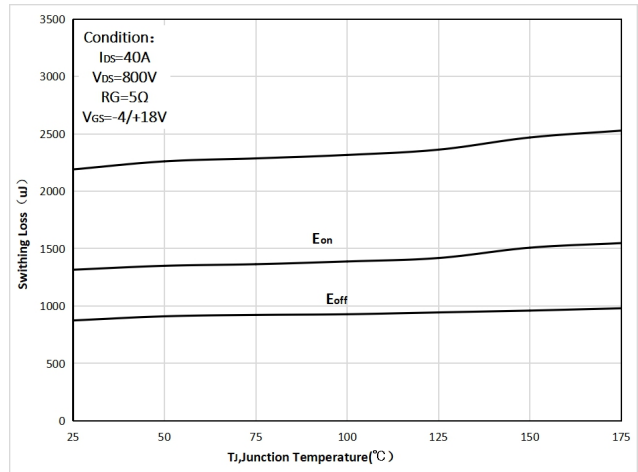
Figure 12. Forward Voltage vs. Junction Temperature



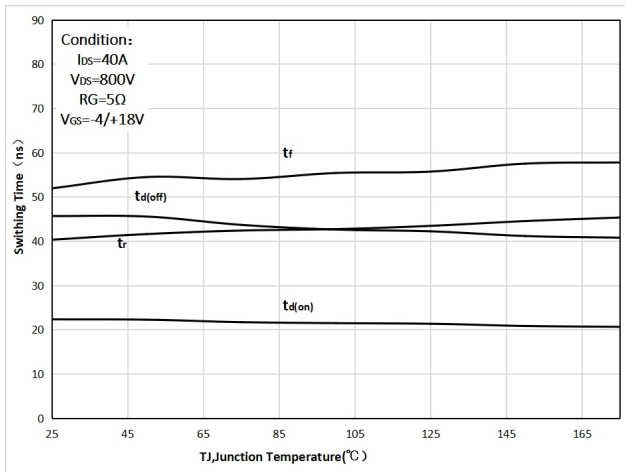
**Figure 13. Body Diode Characteristics for Various Junction Temperatures**



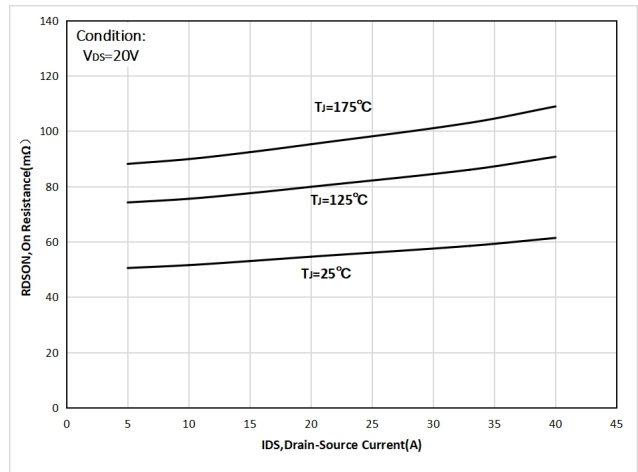
**Figure 14. Clamped Inductive Switching Energy Vs. Temperature**



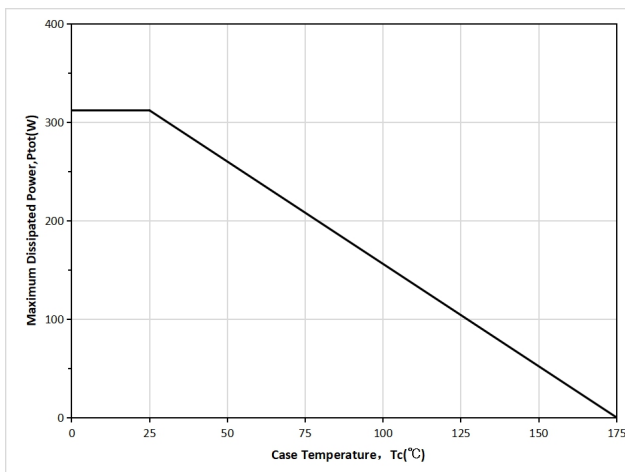
**Figure 15. Switching Times vs. Junction Temperature**



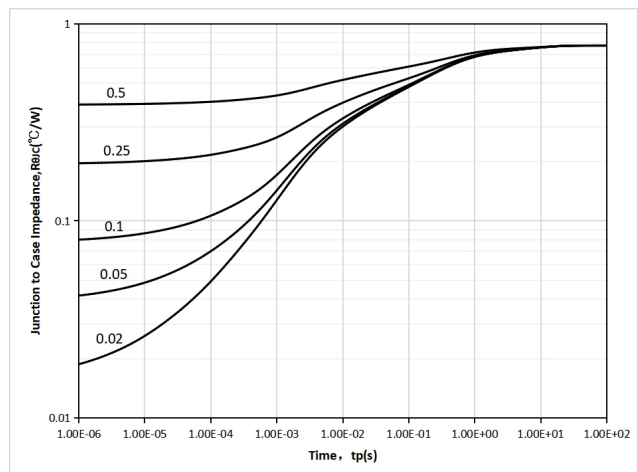
**Figure 16. On-Resistance vs. Drain Current**

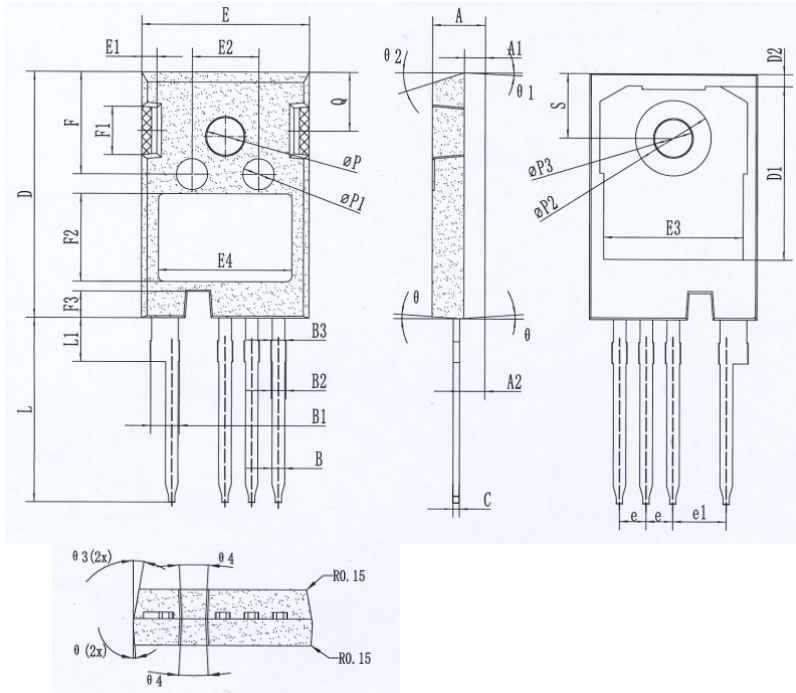


**Figure 17. Power Dissipation Derating**



**Figure 18 Transient Thermal Impedance**



**TO-247-4 Packing Outline Dimensions:****TO-247-4 封装外形尺寸**

Dim.	Mechanical Dimensions /mm		
	MIN	NOM	MAX
A	4.92	5.02	5.12
A1	1.90	2.00	2.10
B	1.15	1.20	1.25
B1	2.50	2.65	2.80
C	0.55	0.60	0.65
D	23.25	23.45	23.65
D1	16.35	16.55	16.75
D2	1.02	1.17	1.32
E	15.74	15.94	16.14
E1	1.25	1.45	1.65
F	9.55	9.75	9.95
F1	4.40	4.60	4.80
e	2.34	2.54	2.74
e1	4.88	5.08	5.28
L	17.37	17.57	17.77
L1	3.97	4.17	4.37
$\Phi P$	3.70	3.80	3.90
$\Phi P1$	2.90	3.00	3.10
$\Phi P2$	7.10	7.20	7.30
S	6.05	6.15	6.25
Q	5.50	5.60	5.70

**Packing 包装**

Package 包装	Pcs/tube 个/管	Tube/ inner box 管/内盒	Inner box/ carton 内盒/外箱	Pcs/carton 个/箱
Tube 管	30	12	6	2160



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