



ON Semiconductor®

# FGH40T65SPD

## 650 V、40 A 场截止沟道 IGBT

### 特性

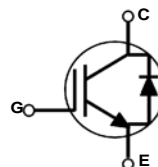
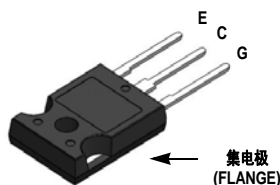
- 最大结温:  $T_J = 175^\circ\text{C}$
- 正温度系数, 易于并联运行
- 高电流能力
- 低饱和电压:  $V_{CE(sat)} = 1.85\text{ V}$  (典型值) @  $I_C = 40\text{ A}$
- 高输入阻抗
- 快速开关
- 紧密的参数分布
- 符合 RoHS 标准
- 短路耐用性  $> 5\ \mu\text{s}$  @  $25^\circ\text{C}$

### 概述

飞兆半导体的场截止第 3 代 IGBT 新系列采用新型场截止 IGBT 技术, 为光伏逆变器、UPS、焊机、电信、ESS 和 PFC 等低导通和开关损耗至关重要的应用提供最佳性能。

### 应用

- 光伏逆变器、UPS、焊机、PFC、电信、ESS



### 绝对最大额定值

符号	说明	FGH40T65SPD-F155	单位
$V_{CES}$	集电极 - 发射极之间电压	650	V
$V_{GES}$	栅极 - 发射极间电压	$\pm 20$	V
	瞬态栅极 - 发射极间电压	$\pm 30$	V
$I_C$	集电极电流 @ $T_C = 25^\circ\text{C}$	80	A
	集电极电流 @ $T_C = 100^\circ\text{C}$	40	A
$I_{CM}$	集电极脉冲电流	120	A
$I_F$	二极管正向电流 @ $T_C = 25^\circ\text{C}$	40	A
	二极管正向电流 @ $T_C = 100^\circ\text{C}$	20	A
$I_{FM}$	二极管最大正向脉冲电流	120	A
$P_D$	最大功耗 @ $T_C = 25^\circ\text{C}$	267	W
	最大功耗 @ $T_C = 100^\circ\text{C}$	134	W
SCWT	短路耐受时间 @ $T_C = 25^\circ\text{C}$	5	$\mu\text{s}$
$T_J$	工作结温	-55 至 +175	$^\circ\text{C}$
$T_{stg}$	存储温度范围	-55 至 +175	$^\circ\text{C}$
$T_L$	用于焊接的最大引脚温度, 距离外壳 1/8", 持续 5 秒	300	$^\circ\text{C}$

#### 注意:

1: 重复额定值: 脉冲受最大结温限制

### 热性能

符号	参数	典型值	最大值	单位
$R_{\theta JC}$ (IGBT)	结点 - 壳体的热阻	-	0.56	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$ (二极管)	结点 - 壳体的热阻	-	1.71	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	结至环境热阻	-	40	$^\circ\text{C}/\text{W}$

## 封装标识与订购信息

器件标识	器件	封装	卷尺寸	带宽	每卷管数量
FGH40T65SPD	FGH40T65SPD-F155	TO-247 G03	-	-	30ea

IGBT 的电气特性  $T_C = 25^\circ\text{C}$  除非另有说明

符号	参数	测试条件	最小值	典型值	最大值	单位
<b>关断特性</b>						
$BV_{CES}$	集电极 - 发射极击穿电压	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650	-	-	V
$\frac{DBV_{CES}}{DT_J}$	击穿温度系数电压	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	-	0.6	-	$V/^\circ\text{C}$
$I_{CES}$	集电极切断电流	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E 漏电流	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	$\pm 400$	nA
<b>导通特性</b>						
$V_{GE(th)}$	G-E 阈值电压	$I_C = 40\text{ mA}, V_{CE} = V_{GE}$	4	5.5	7.5	V
$V_{CE(sat)}$	集电极 - 发射极间饱和电压	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}$	-	1.85	2.4	V
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, T_C = 175^\circ\text{C}$	-	2.51	-	V
<b>动态特性</b>						
$C_{ies}$	输入电容	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	1370	-	pF
$C_{oes}$	输出电容		-	94	-	pF
$C_{res}$	反向传输电容		-	16	-	pF
<b>开关特性</b>						
$T_{d(on)}$	导通延迟时间	$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 6\ \Omega, V_{GE} = 15\text{ V},$ 感性负载, $T_C = 25^\circ\text{C}$	-	16	-	ns
$T_r$	上升时间		-	42	-	ns
$T_{d(off)}$	关断延迟时间		-	37	-	ns
$T_f$	下降时间		-	11	-	ns
$E_{on}$	导通开关损耗		-	1.16	-	mJ
$E_{off}$	关断开关损耗		-	0.28	-	mJ
$E_{ts}$	总开关损耗		-	1.44	-	mJ
$T_{d(on)}$	导通延迟时间	$V_{CC} = 400\text{ V}, I_C = 40\text{ A}, R_G = 6\ \Omega, V_{GE} = 15\text{ V},$ 感性负载, $T_C = 175^\circ\text{C}$	-	14	-	ns
$T_r$	上升时间		-	49	-	ns
$T_{d(off)}$	关断延迟时间		-	38	-	ns
$T_f$	下降时间		-	18	-	ns
$E_{on}$	导通开关损耗		-	1.54	-	mJ
$E_{off}$	关断开关损耗		-	0.52	-	mJ
$E_{ts}$	总开关损耗		-	2.06	-	mJ
$T_{SC}$	短路耐受时间	$V_{CC} = 400\text{ V}, V_{GE} = 15\text{ V}, R_G = 10\ \Omega$	5	-	-	$\mu\text{s}$

**IGBT 电气特性** (接上页)

符号	参数	测试条件	最小值	典型值	最大值	单位
$Q_g$	总栅极电荷	$V_{CE} = 400\text{ V}, I_C = 40\text{ A},$ $V_{GE} = 15\text{ V}$	-	35	-	nC
$Q_{ge}$	栅极-发射极间电荷		-	11	-	nC
$Q_{gc}$	栅极-发射极间电荷		-	12	-	nC

**二极管电气特性**  $T_C = 25^\circ\text{C}$  除非另有说明

符号	参数	测试条件	最小值	典型值	最大值	单位	
$V_{FM}$	二极管正向电压	$I_F = 20\text{ A}$	$T_C = 25^\circ\text{C}$	-	2.2	2.7	V
			$T_C = 175^\circ\text{C}$	-	1.9	-	
$E_{rec}$	反向恢复电能	$I_F = 20\text{ A}, di_F/dt=200\text{ A}/\mu\text{s}$	$T_C = 175^\circ\text{C}$	-	76	-	$\mu\text{J}$
$T_{rr}$	二极管反向恢复时间		$T_C = 25^\circ\text{C}$	-	34	-	ns
			$T_C = 175^\circ\text{C}$	-	196	-	
$Q_{rr}$	二极管反向恢复电荷		$T_C = 25^\circ\text{C}$	-	52	-	nC
		$T_C = 175^\circ\text{C}$	-	638	-		

## 典型性能特征

图 1. 典型输出特性

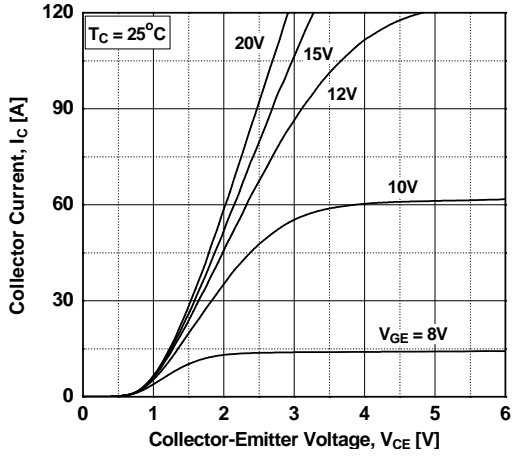


图 2. 典型输出特性

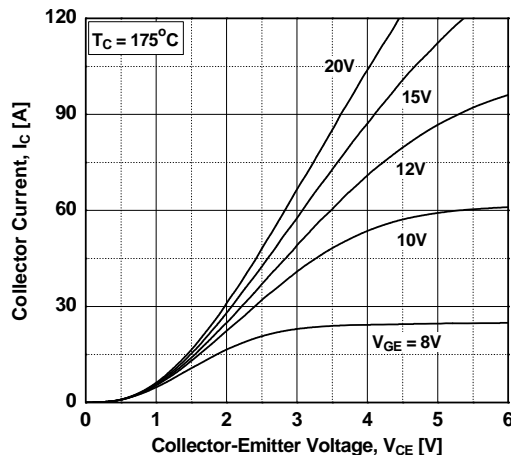


图 3. 典型饱和电压特性

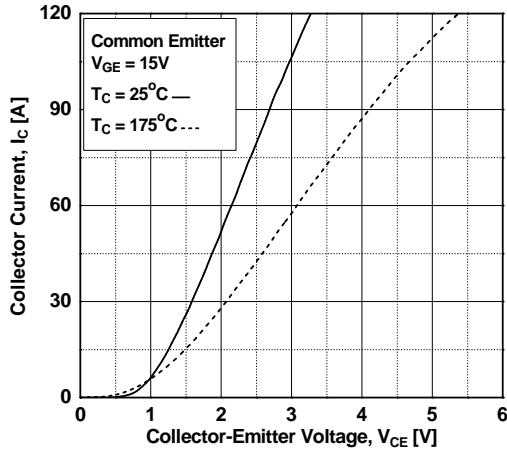


图 4. 饱和电压与壳温的关系（可变电流强度下）

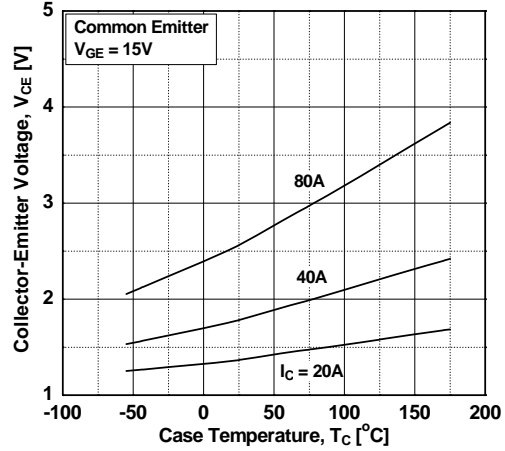


图 5. 饱和电压与 Vge 的关系

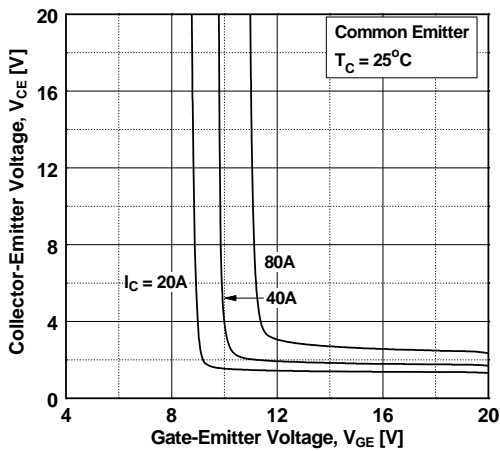
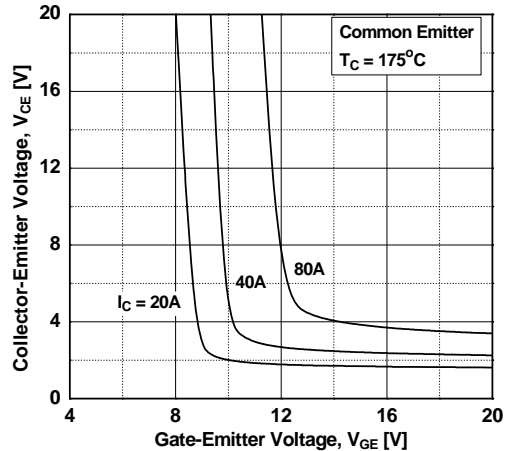


图 6. 饱和电压与 Vge 的关系



## 典型性能特征

图 7. 电容特性

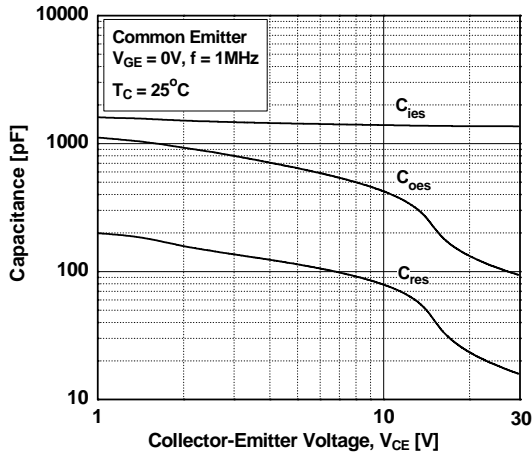


图 8. 栅极电荷特性

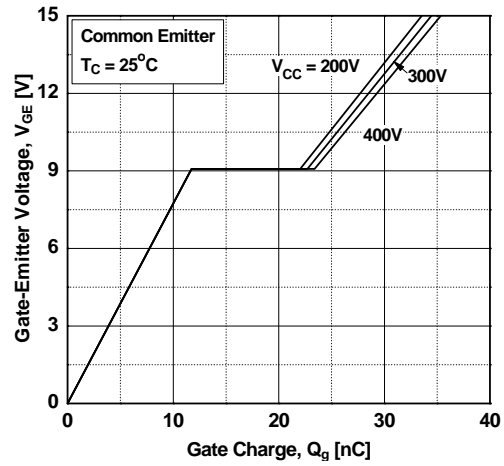


图 9. 导通特性与栅极电阻的关系

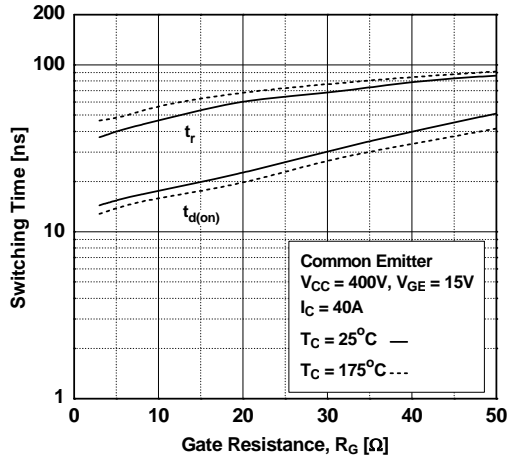


图 10. 关断特性与栅极电阻的关系

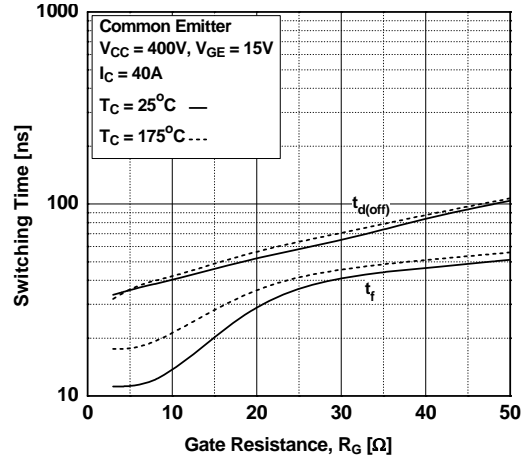


图 11. 开关损耗与栅极电阻的关系

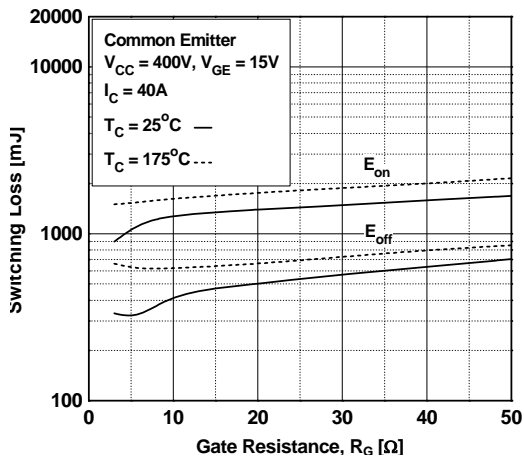
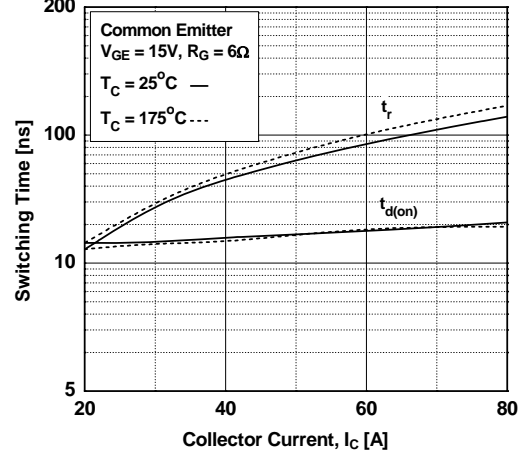


图 12. 导通特性与集电极电流的关系



典型性能特征

图 13. 关断特性与集电极电流的关系

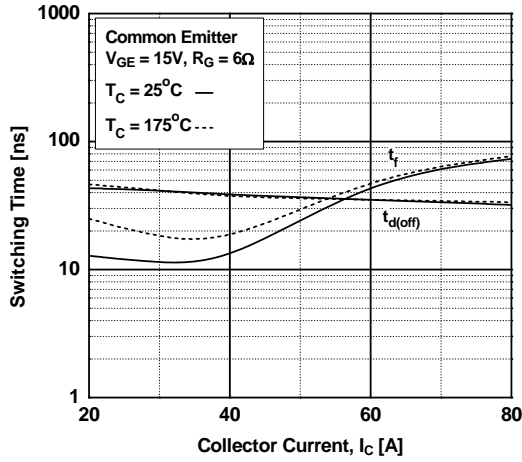


图 14. 开关损耗与集电极电流的关系

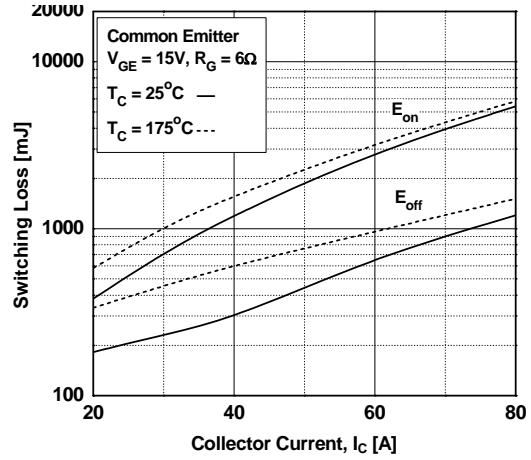


图 15. 负载电流与频率的关系

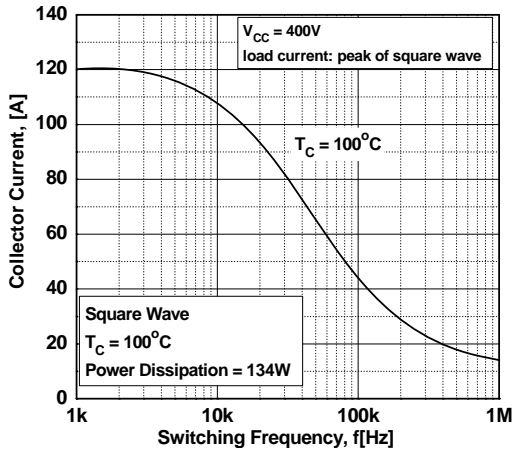


图 16. SOA 特性

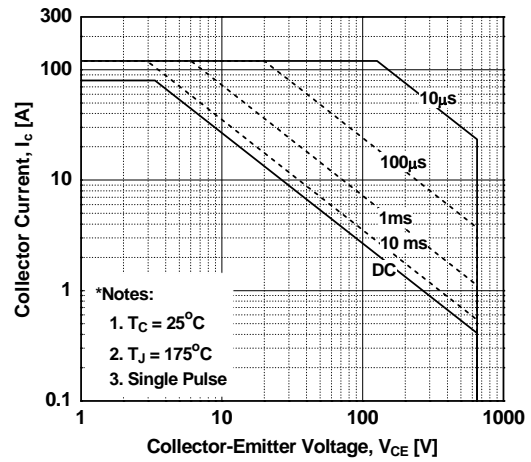


图 17. 正向特性

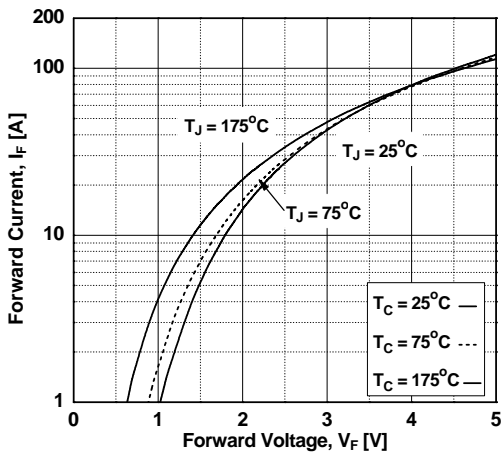
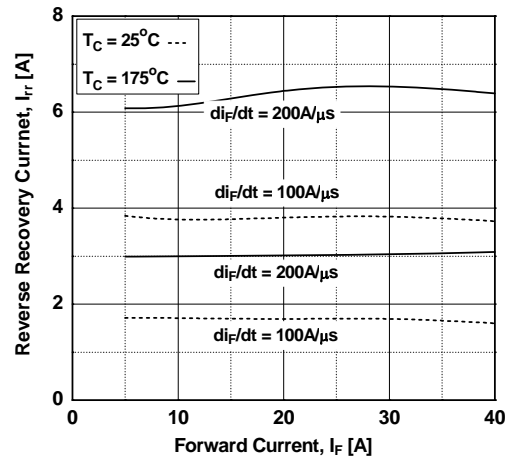


图 18. 反向恢复电流



典型性能特征

图 19. 反向恢复时间

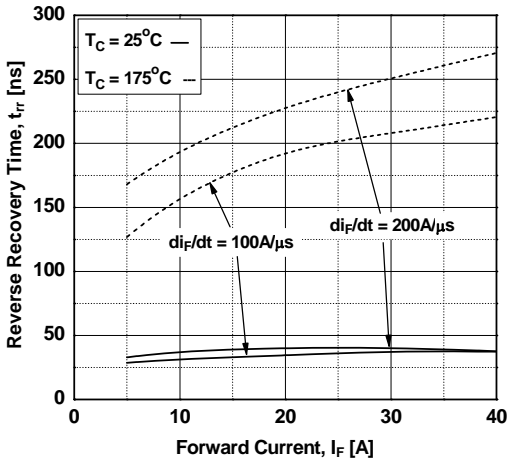


图 20. 存储电荷

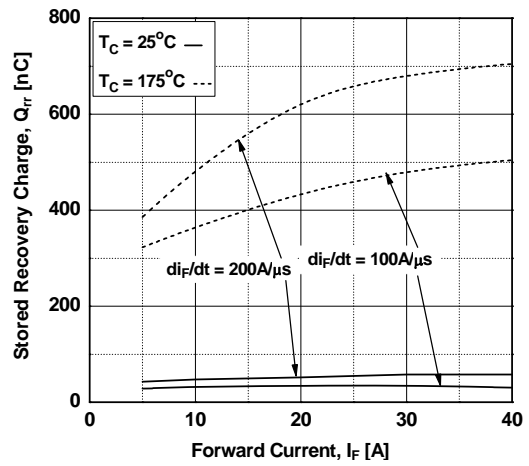


图 21. IGBT 瞬态热阻抗

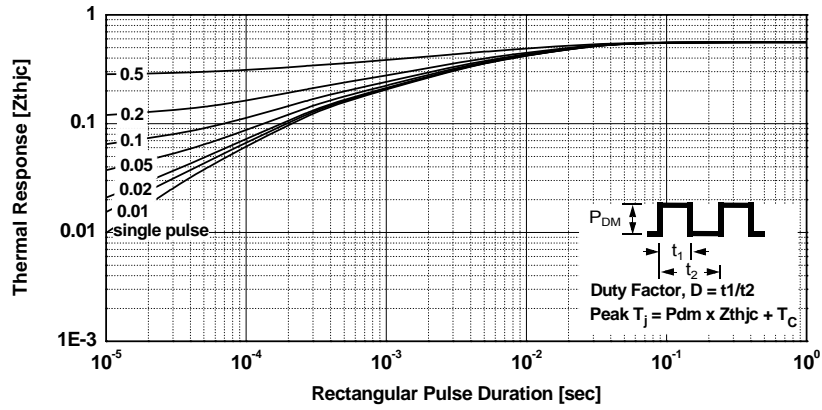
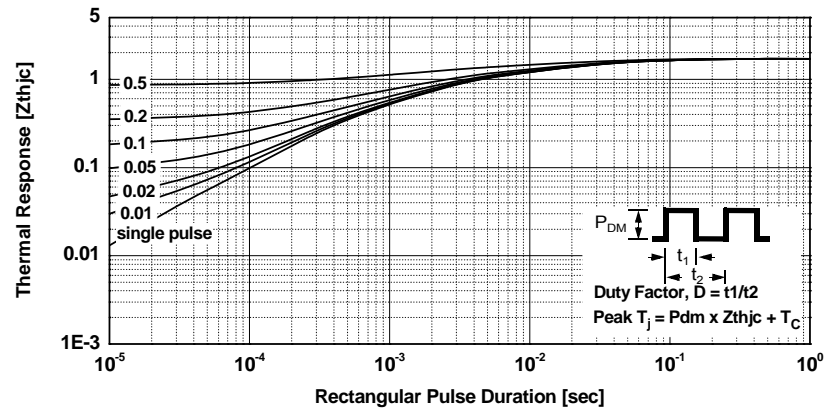
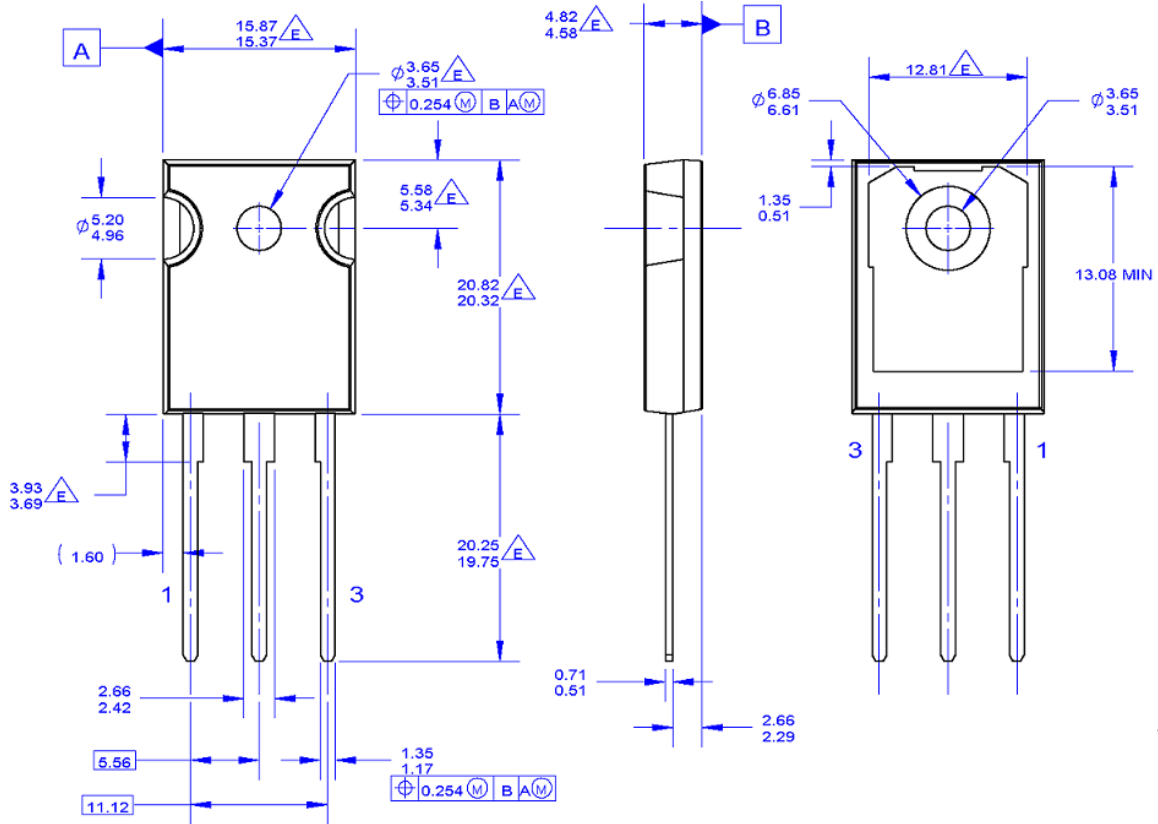


图 22. 二极管瞬态热阻抗



机械尺寸



- NOTES: UNLESS OTHERWISE SPECIFIED.
- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
  - B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - C. ALL DIMENSIONS ARE IN MILLIMETERS.
  - D. DRAWING CONFORMS TO ASME Y14.5 - 1994
  - $\triangle E$  DOES NOT COMPLY JEDEC STANDARD VALUE
  - F. DRAWING FILENAME: MKT-TO247G03\_REV01

图 23. TO-247 3L - TO-247, 模塑封装, 3 引脚, JEDEC AB 长引脚

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