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2013 年 12 月

# FGB40N60SM

## 600 V, 40 A 场截止 IGBT



### 特性

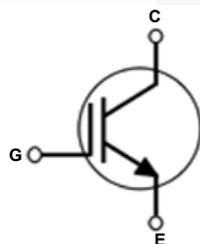
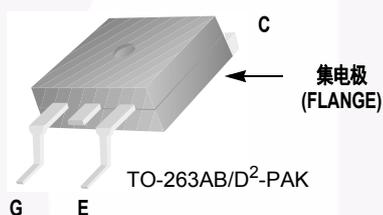
- 最大结温:  $T_J = 175^\circ\text{C}$
- 正温度系数, 易于并联运行
- 高电流能力
- 低饱和电压:  $V_{CE(sat)} = 1.9\text{ V}$  (典型值) @  $I_C = 40\text{ A}$
- 高输入阻抗
- 快速开关
- 紧密的参数分布
- 符合 RoHS 标准
- 仅红外线回流焊

### 概述

飞兆半导体的新型场截止第二代 IGBT 系列产品采用创新型场截止 IGBT 技术, 为焊机和 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

- 焊机、PFC



### 绝对最大额定值

符号	说明	额定值	单位
$V_{CES}$	集电极 - 发射极之间电压	600	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
$I_{CM(1)}$	集电极脉冲电流	120	A
$P_D$	最大功耗 @ $T_C = 25^\circ\text{C}$	349	W
	最大功耗 @ $T_C = 100^\circ\text{C}$	174	W
$T_J$	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	500	$^\circ\text{C}$

#### 注意:

1: 重复额定值: 脉宽受最大结温限制

### 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	-	0.43	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	结至环境热阻	-	62.5	$^{\circ}\text{C}/\text{W}$

### 封装标识与订购信息

器件标识	器件	封装	卷尺寸	带宽	数量
FGB40N60SM	FGB40N60SM	TO-263AB(D <sup>2</sup> -PAK)	-	-	50

### IGBT 电气特性 TC = 25°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	$V_{GE} = 0V, I_C = 250\mu\text{A}$	600	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	击穿温度系数电压	$V_{GE} = 0V, I_C = 250\mu\text{A}$	-	0.6	-	$\text{V}/^{\circ}\text{C}$
$I_{CES}$	集电极切断电流	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E 漏电流	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	$\pm 400$	nA
<b>导通特性</b>						
$V_{GE(th)}$	G-E 阈值电压	$I_C = 250\mu\text{A}, V_{CE} = V_{GE}$	3.5	4.5	6.0	V
$V_{CE(sat)}$	集电极 - 发射极间饱和电压	$I_C = 40A, V_{GE} = 15V$	-	1.9	2.3	V
		$I_C = 40A, V_{GE} = 15V, T_C = 175^{\circ}\text{C}$	-	2.1	-	V
<b>动态特性</b>						
$C_{ies}$	输入电容	$V_{CE} = 30V, V_{GE} = 0V, f = 1\text{MHz}$	-	1880	-	pF
$C_{oes}$	输出电容		-	180	-	pF
$C_{res}$	反向传输电容		-	50	-	pF
<b>开关特性</b>						
$t_{d(on)}$	导通延迟时间	$V_{CC} = 400V, I_C = 40A, R_G = 6\Omega, V_{GE} = 15V, \text{感性负载}, T_C = 25^{\circ}\text{C}$	-	12	16	ns
$t_r$	上升时间		-	20	28	ns
$t_{d(off)}$	关断延迟时间		-	92	120	ns
$t_f$	下降时间		-	13	17	ns
$E_{on}$	开通开关损耗		-	0.87	1.30	mJ
$E_{off}$	关断开关损耗		-	0.26	0.34	mJ
$E_{ts}$	总开关损耗		-	1.13	1.64	mJ
$t_{d(on)}$	导通延迟时间	$V_{CC} = 400V, I_C = 40A, R_G = 6\Omega, V_{GE} = 15V, \text{感性负载}, T_C = 175^{\circ}\text{C}$	-	15	-	ns
$t_r$	上升时间		-	22	-	ns
$t_{d(off)}$	关断延迟时间		-	116	-	ns
$t_f$	下降时间		-	16	-	ns
$E_{on}$	导通开关损耗		-	0.97	-	mJ
$E_{off}$	关断开关损耗		-	0.60	-	mJ
$E_{ts}$	总开关损耗		-	1.57	-	mJ

## IGBT 电气特性 (续)

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	$V_{CE} = 400V, I_C = 40A,$ $V_{GE} = 15V$	-	119	180	nC
$Q_{ge}$	栅极-发射极间电荷		-	13	20	nC
$Q_{gc}$	栅极-发射极间电荷		-	58	90	nC



典型性能特征

图 1. 典型输出特性

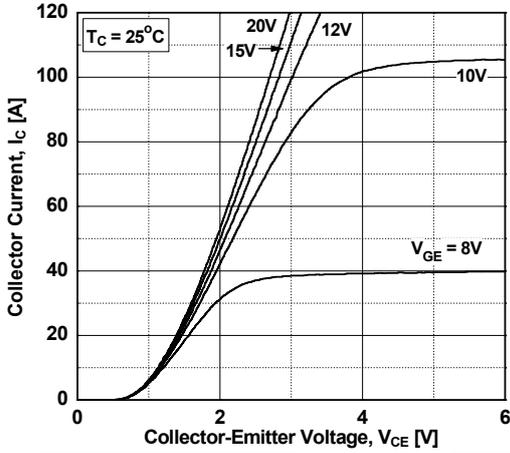


图 2. 典型输出特性

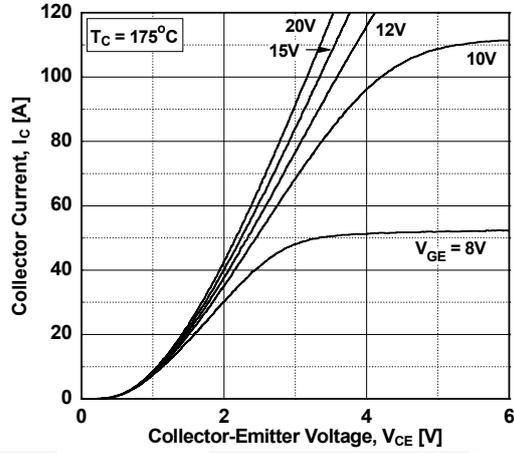


图 3. 典型饱和电压特性图

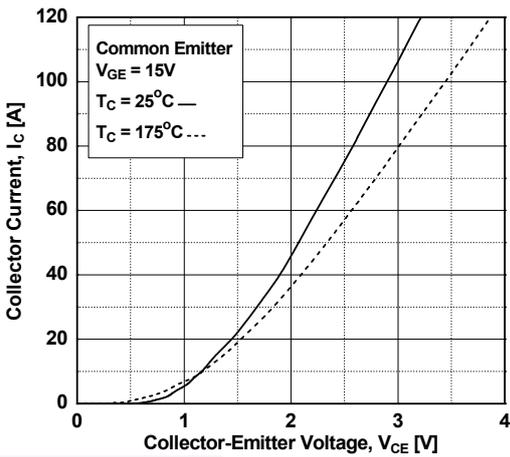


图 4. 饱和电压与可变电流强度下壳温的关系

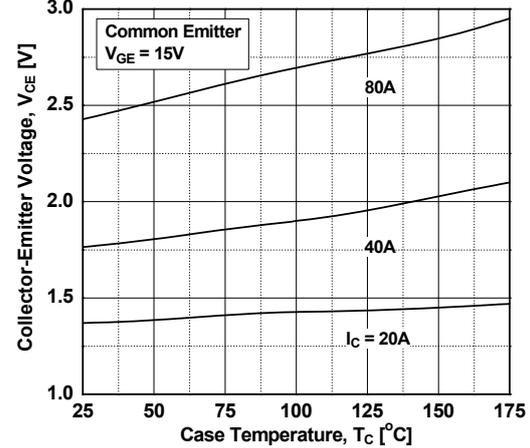


图 5. 饱和电压与 V\_GE 的关系

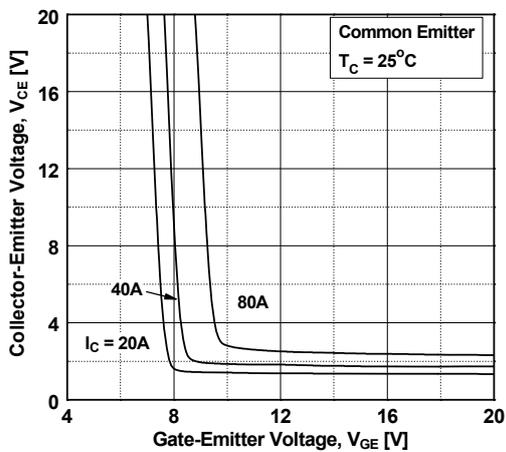
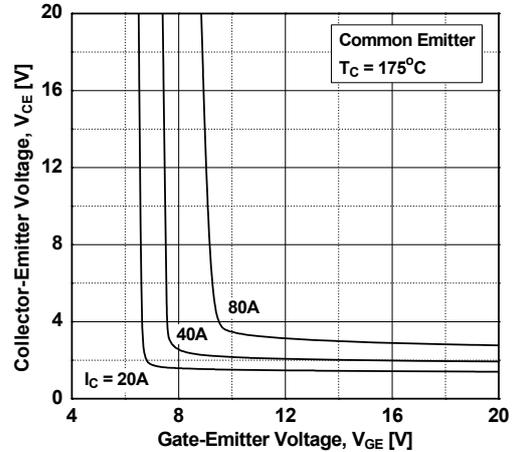


图 6. 饱和电压与 V\_GE 的关系



典型性能特征

图 7. 电容特性

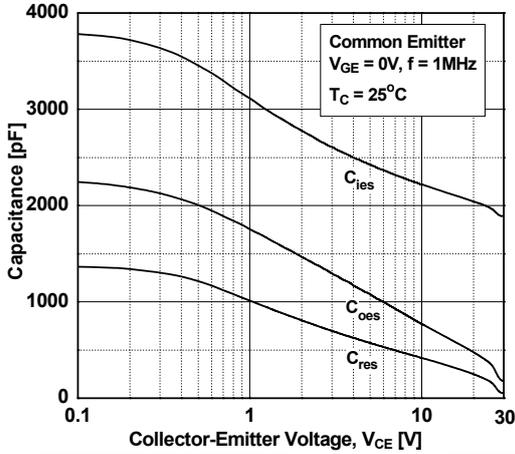


图 8. 栅极电荷特性

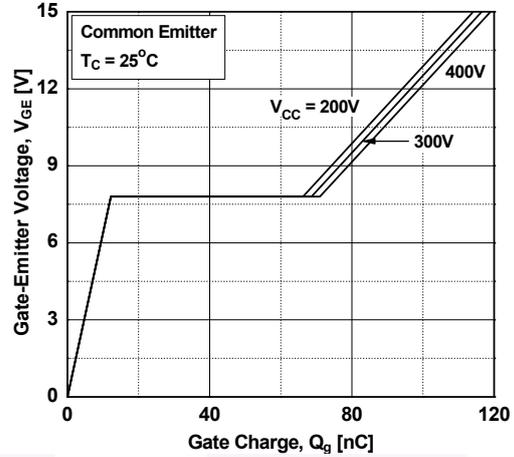


图 9. 导通特性与栅极电阻的关系

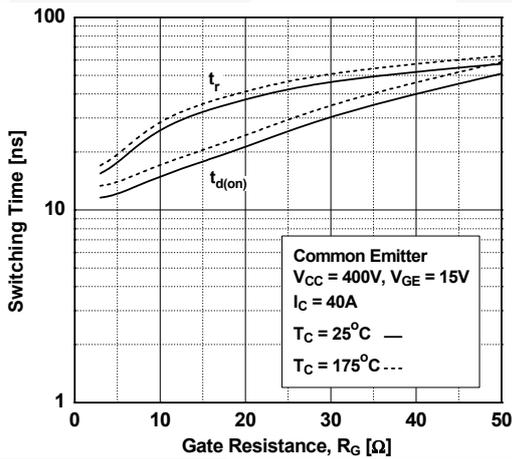


图 10. 关断特性与栅极电阻的关系

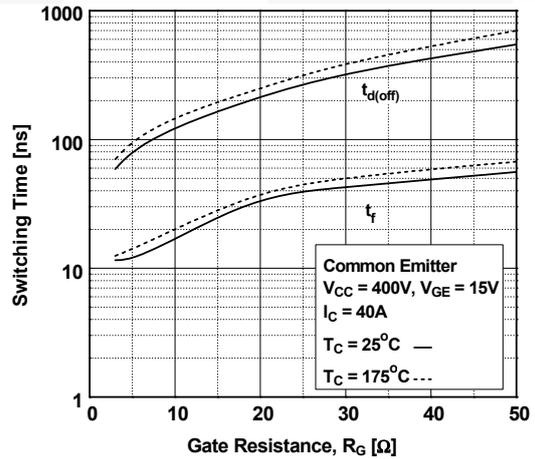


图 11. 开关损耗与栅极电阻的关系

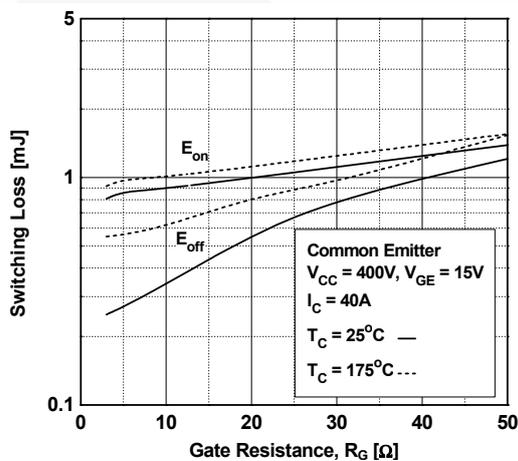
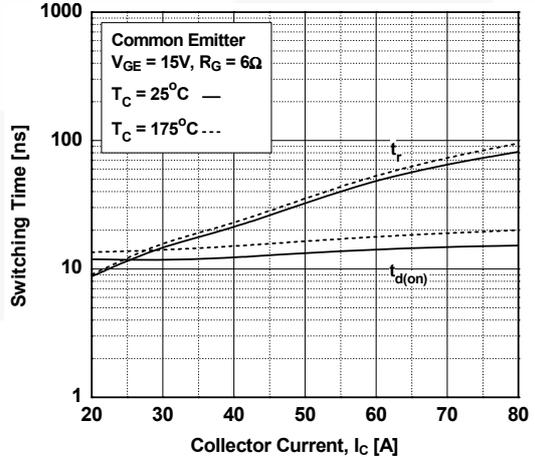


图 12. 导通特性与集电极电流的关系



典型性能特征

图 13. 关断特性与集电极电流的关系

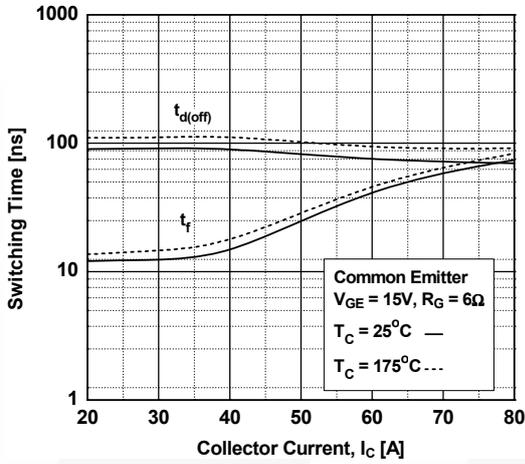


图 14. 开关损耗与集电极电流的关系

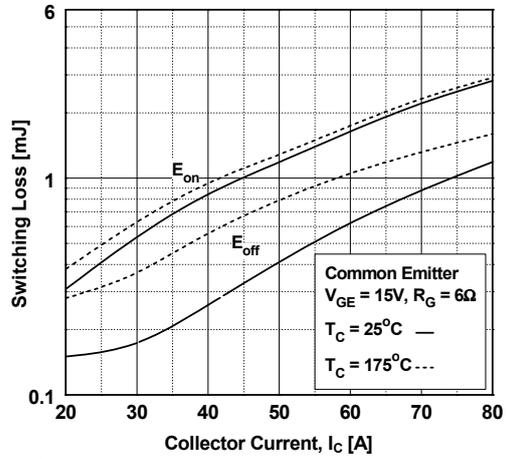


图 15. 负载电流与频率的关系

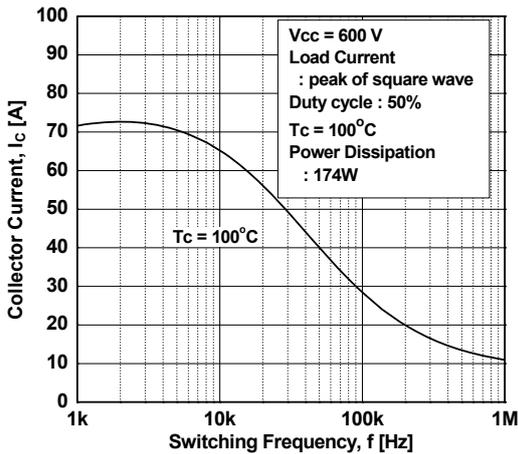


图 16. SOA 特性

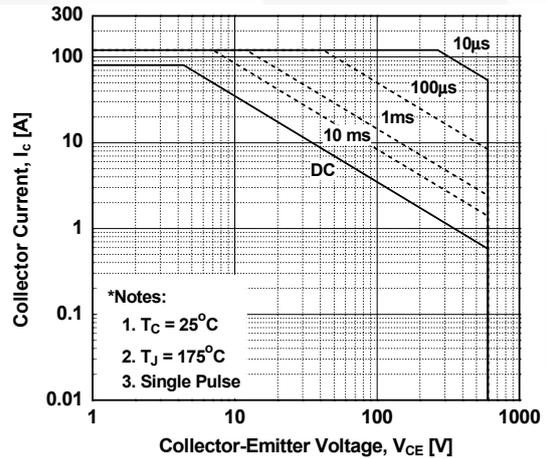
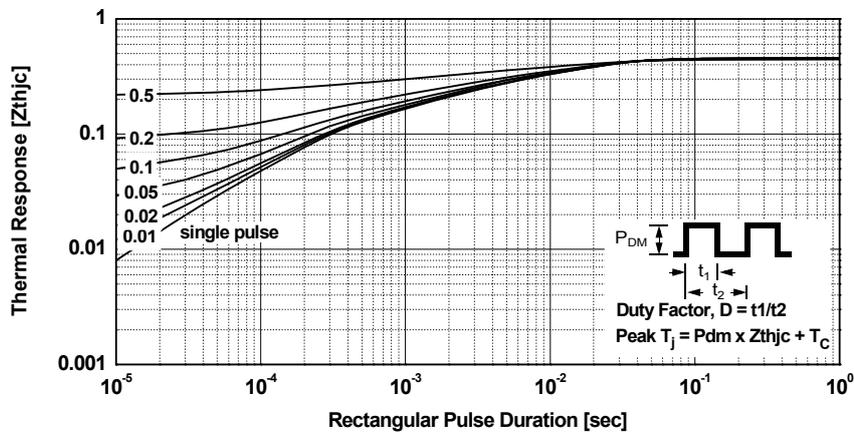
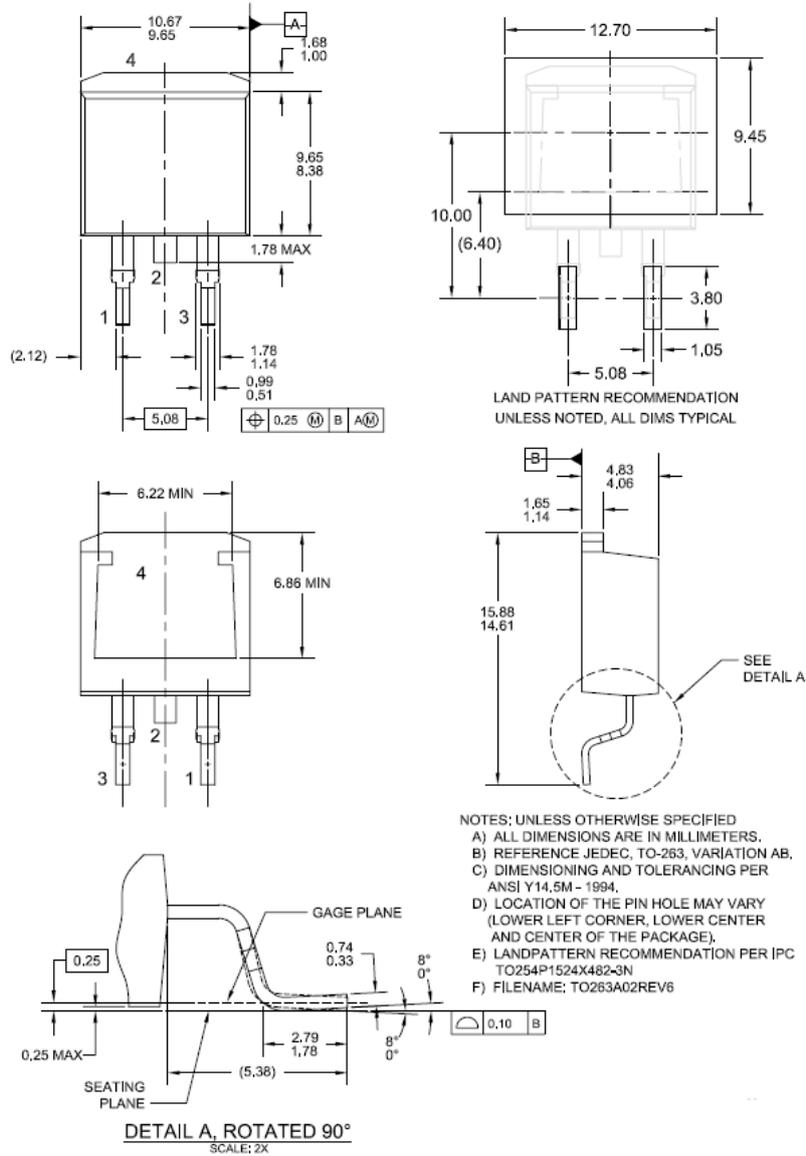


图 17. IGBT 瞬态热阻



## 机械尺寸



**图 18. TO-263 2L (D2PAK) - 2LD, TO263, SURFACE MOUNT**

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