

# ANDNGTB05N60R2DT4G/D

## NGTB05N60R2DT4G

### 电冰箱 Compressor, Fan Motor

#### 应用资料



ON Semiconductor®

www.onsemi.cn

#### 应用资料

可以使之作为 IGBT 的 Free Wheel Diode (FWD)来工作。当然,作为二极管其为高速设计,  $t_{rr} < 75\text{ns}$ , 确保高速性能。此次的 RC-IGBT 还采用了我司的 FS2 构造, 该工艺被称为 RC2-IGBT。

#### 1. 概要

RC-IGBT 为 Reverse Conducting Insulated Gate Bipolar Transistor 的略称, 是与 FWD 搭载于同一芯片的 IGBT。

如同 Inverter 电路, 当同时需要 IGBT 与 FWD 时, 由于它们集成于同一芯片, 所以不但减小了封装面积, 还保持了两者的热平衡。

本资料将介绍使用 DPak 的 RC-IGBT 的应用。

#### 2. RC-IGBT 与 IGBT 的截面构造 (一般说明)

表.1 总结了两者在构造上及动作上的相似点与不同点, 同时进行了截面构造的比较。

RC-IGBT: 通过在背面的一部分生成 N+(高浓度 N 层) 来形成二极管。因此 Collector (C) 侧为 Cathode, Emitter (E) 侧为 Anode, 从电路角度上

表.1 RC-IGBT 与 IGBT 的构造比较

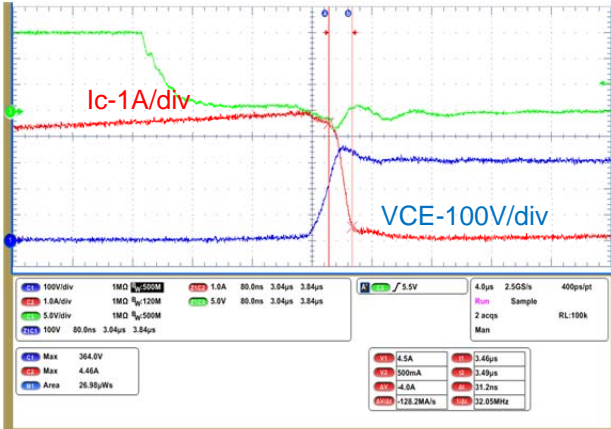
	RC-IGBT	IGBT
芯片构造	FRD 领域的形成: 将背面的 P+ 层的一部分置换成 N+ 层。	背面都为 P+ 层。 FRD 为独立的芯片。
电路记号		
芯片截面图 (以一般的构造说明)		

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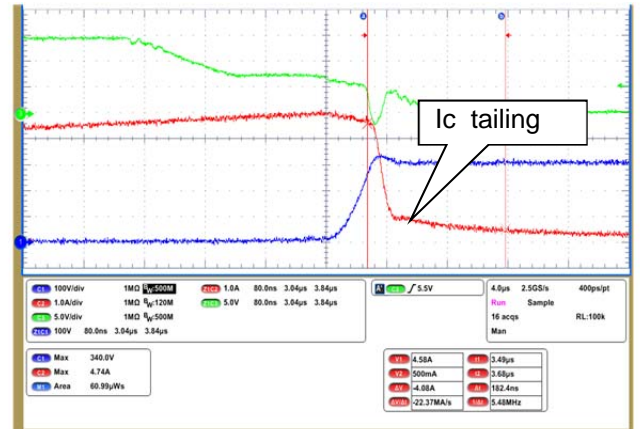
## 3. RC2-IGBT 的高速开关性能

FS2 构造本来为 ON Semi 面向高速开关用途(例如 Full-Switching PFC 用途的 IGBT)所开发的工艺。通过将该构造 用于这次开发的 RC2-IGBT,与以往 (NPT 构造)IGBT 相比,实现了 tf 的大幅高速化。

WP.1 & 2 为工作波形例。WP.1为RC2-IGBT的5A规格品的工作时的tf波形。与WP.2的10A规格NPT品相比,实现了无 tf Tailing的高速化。



WP.1 FS2-IGBT Ic=5A tf=31.2ns



WP.2 NPT-IGBT Ic=5A tf=102ns

## 4. RC2-IGBT 的产品系列

RC2-IGBT将IGBT与FRD集成于一个芯片,实现了小型化, ON Semi充分利用该特点,推出了以DPak 品为中心的产品系列。

Ic额定电流: 由于实现了小型封装,由NGTB03N60R2DT4G的Ic=4.5A 实现了NGTB10N60R2DT4G的Ic=10A。

表.1 RC2-IGBT 产品系列

Type No.	Package	Absolute maximum ratings			Electrical characteristics /Ta=25°C	FRD Electrical Characteristics /		
		VCES [V]	IC @Tc=25°C [A]	IC @Tc=100°C [A]	ICP @Tc=25°C [A]	VCE(sat) typ [V]	VF typ [V]	trr typ [ns]
			9	4.5	12	1.7(3A)	1.5	65*1
NGTB03N60R2DT4G	DPAK	600	16	8	20	1.65(5A)	1.5	75*1
NGTB05N60R2DT4G	DPAK		20	10	40	1.7(10A)	1.5	90*1
NGTB10N60R2DT4G	DPAK		24	14	60	1.85(15A)	1.7	95*1
NGTB15N60R2FG	TO-220F-3FS							

\*1 IF=Ic(Tc=100°C). VR=300V, di/dt=300A/μs

5. RC-IGBT的应用图

Fig.1:以 DPAK封装的NGBT05N60R2DT4G为中心的Application map.

最适用于电冰箱等工作频率较高(15kHz)的Fan Motor.

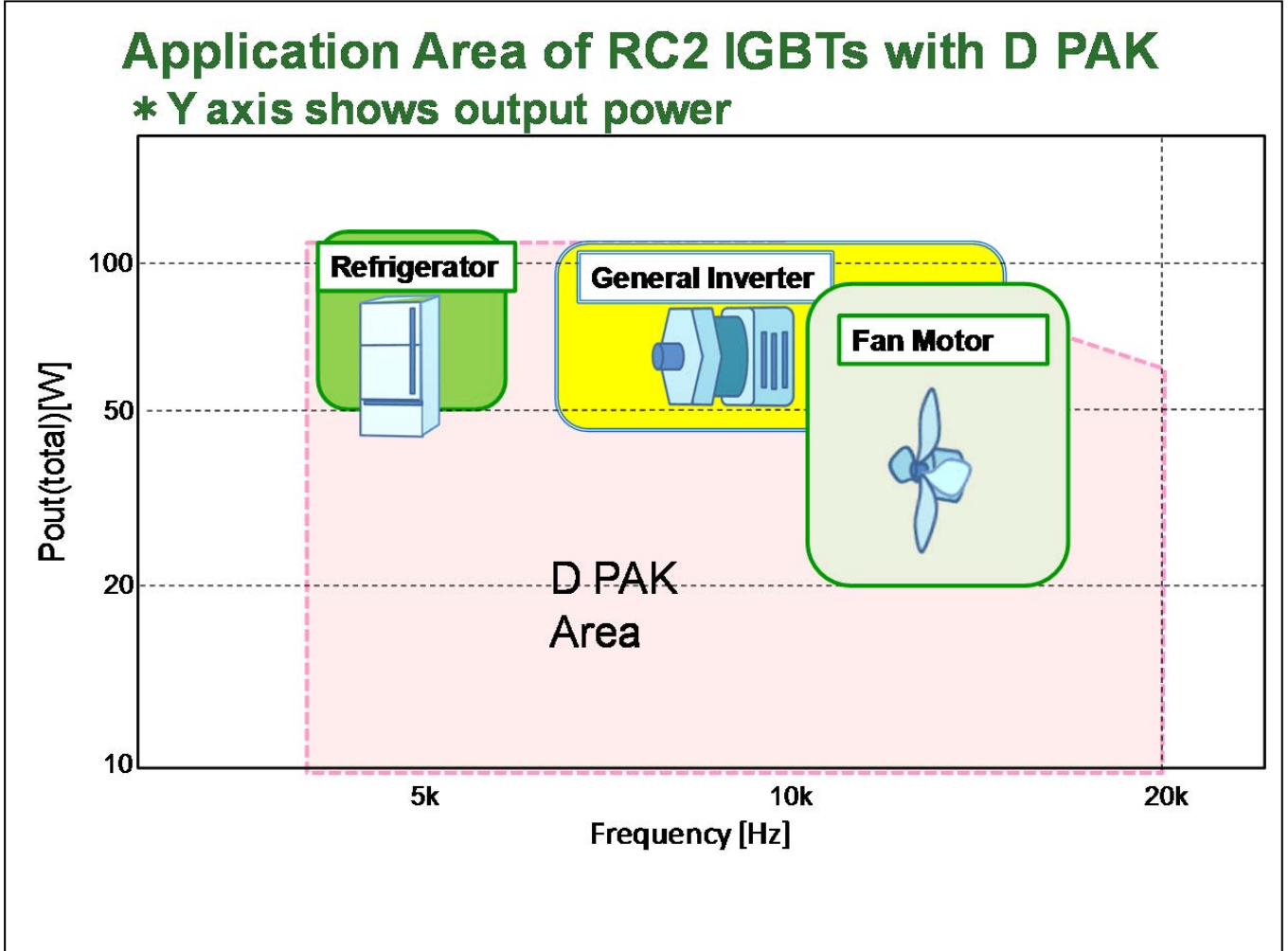


Fig.1 RC-IGBT(D PAK 品)的应用领域

6. BLDCモーターでの動作

表.2 IGBT DC 规格 与他社的比较

6-1) 他社製品とのDC定格の比較

与使用于电冰箱Compressor的他社IGBT的DC额定值比较(表.2).  
 NGTB03N60R2DT4G和05N60R2DT4G都比A IGBT的VCE(sat)值低, 因此可降低导通损失。

	Ic[A] @Tc=100°C	VCE(sat) typ[V]	VF typ[V]
NGTB03N60R2DT4G	4.5	1.7(3A)	1.5(3A)
NGTB05N60R2DT4G	8.0	1.65(5A)	1.5(5A)
A IGBT	4.2	1.9(3A)	1.9(3A)

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## 6-2) 应用于BLDC Motor的工作比较

以Fig.3的电路构成驱动3相BLDC Motor动时的特性如Fig.2所示。(120°PWM驱动,  $f_c=6.8\text{kHz}$ ). 安装于PCB的各IGBT的工作温度 $T_c$ 测定结果。如同上述DC额定值,  $V_{CE(sat)}$ 值低于IGBT A的NGTB03N60R2DT4G与05N60R2的温度较低。测定基板的素子安装情况与工作研究基板(一部)如Photo.1所示。

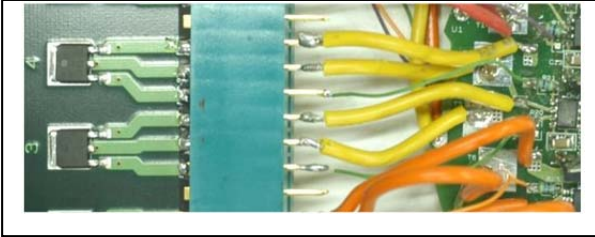


Photo.1 工作研究基板(一部)

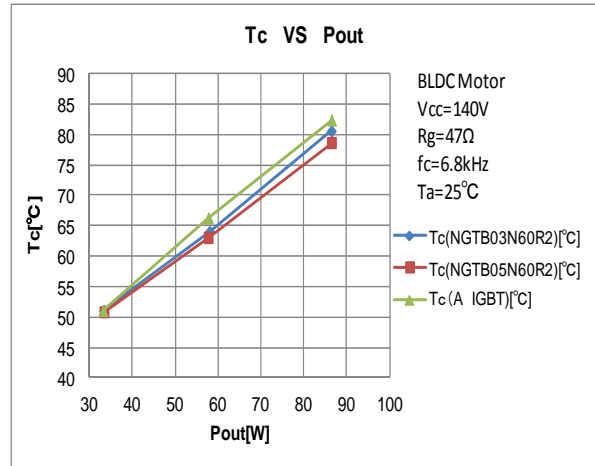


Fig.2 工作特性 Tc VS Ic

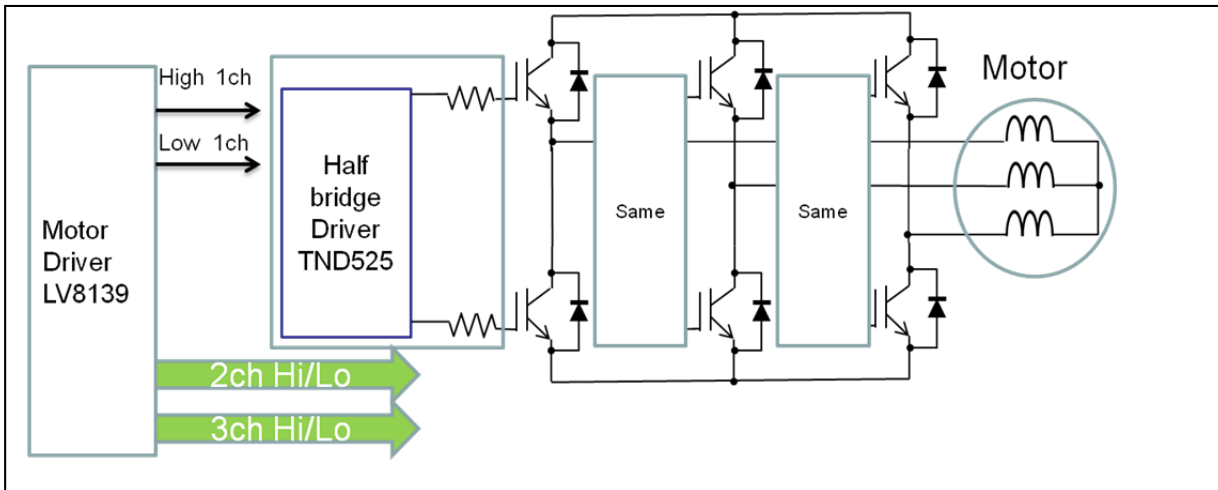


Fig.3 工作电路框图

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