



F2967

LINEAR INTEGRATED CIRCUIT

FOR VARIABLE SPEED FAN MOTOR SINGLE-PHASE FULL-WAVE PRE-DRIVER

DESCRIPTION

The UTC **F2967** is a single-phase fan motor pre-driver IC. This IC has variable speed function that works with an external Pulse-Width Modulation signal. A quiet and low power consumption motor driver circuit can be implemented by adding a small number of external components.

This IC is optimal for driving large scale fan motors (with large air volume and large current) such as those used in servers and consumer products.

FEATURES

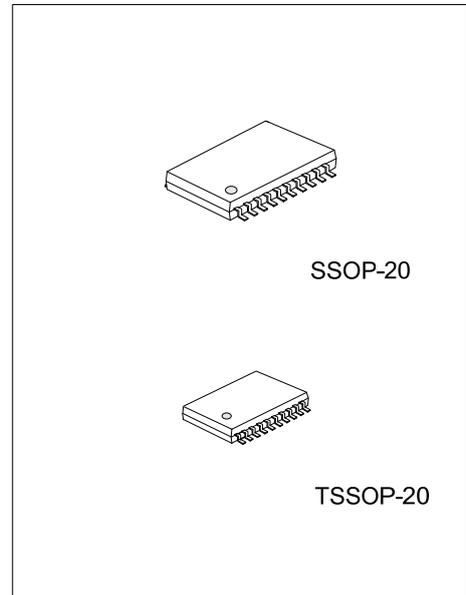
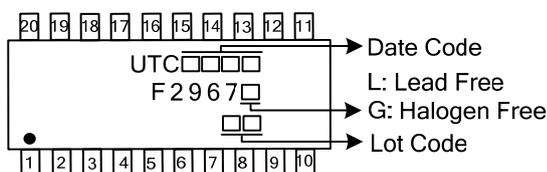
- * Single-phase full-wave drive
- * Variable speed control with External PWM input
- * Current limiter circuit
- * Reactive current cut circuit
- * Compatible with 12V, 24V, and 48V power supplies
- * Minimum speed setting pin
- * Reference voltage output pin for Hall bias
- * automatic reset and Lock protection functions incorporated
- * (Rotation speed detection), RD (Lock detection) output

ORDERING INFORMATION

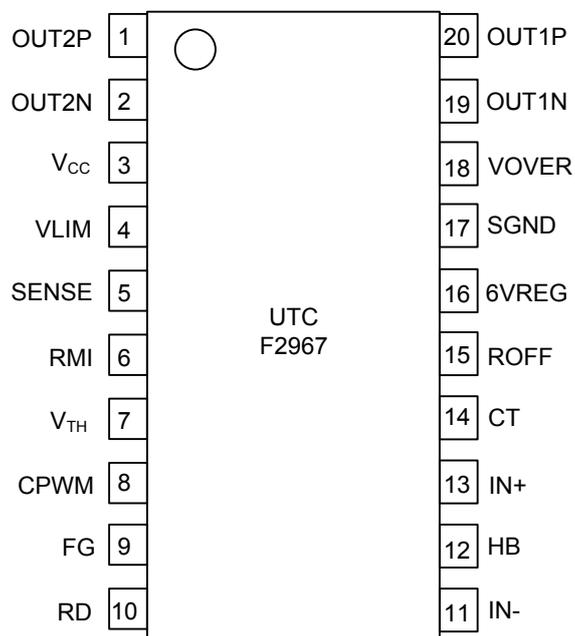
Ordering Number		Package	Packing
Lead Free	Halogen Free		
F2967L-R20-R	F2967G-R20-R	SSOP-20	Tape Reel
F2967L-P20-R	F2967G-P20-R	TSSOP-20	Tape Reel

<p>F2967G-R20-R</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) R: Tape Reel (2) R20: SSOP-20, P20: TSSOP-20 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING



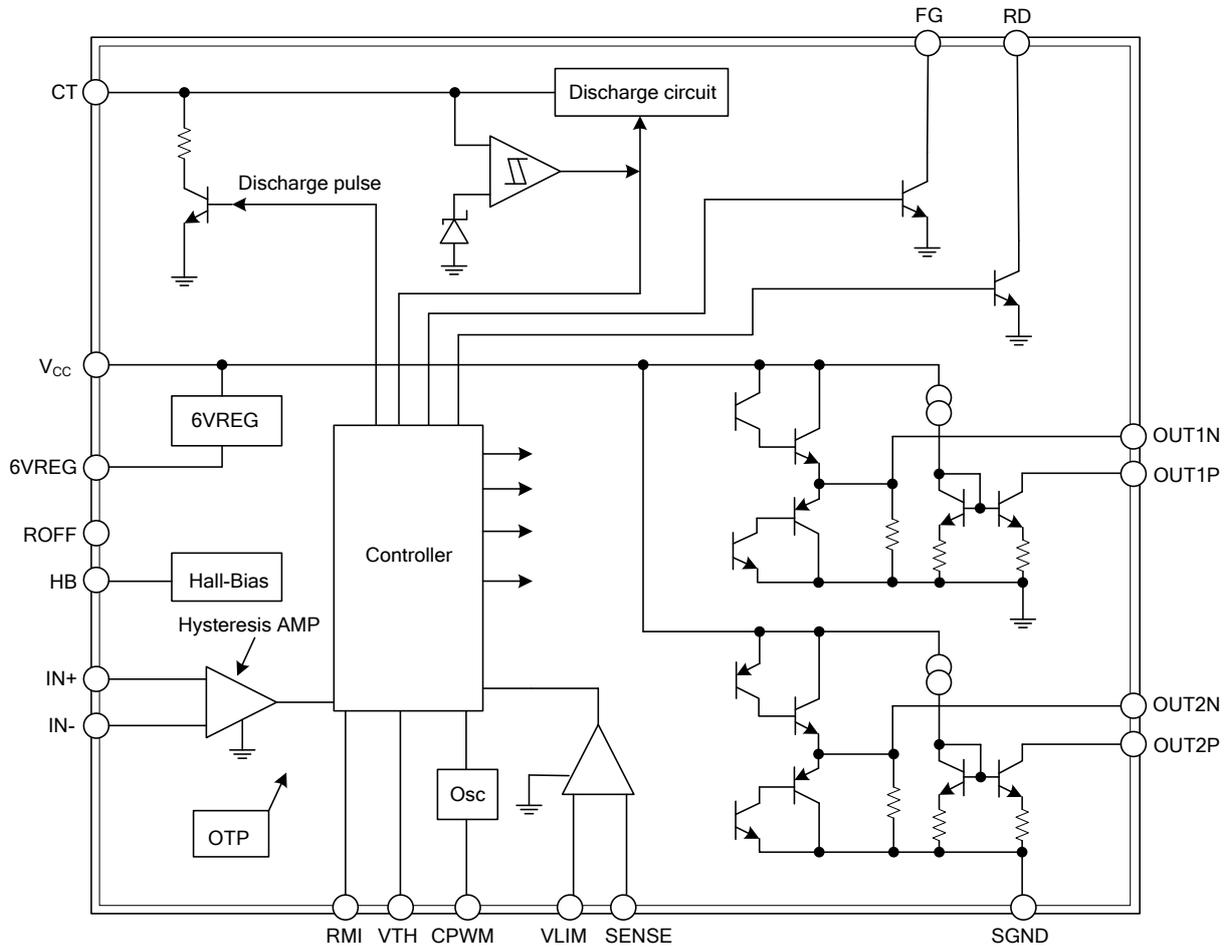
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	OUT2P	Output2P
2	OUT2N	Output2N
3	V _{CC}	Power supply
4	VLIM	Setting limit current pin
5	SENSE	Sense pin of current limiter
6	RMI	Lowest speed setting voltage
7	V _{TH}	Variable speed function input
8	CPWM	PWM oscillator frequency setting capacitor
9	FG	Speed detection output
10	RD	lock detection output
11	IN-	The hall sensor input
12	HB	Power the hall sensor 1.25V
13	IN+	The hall sensor input
14	CT	Setting lock protection time
15	ROFF	The pin sets soft switching time
16	6VREG	V _{REF} 6V
17	SGND	Logic GND
18	VOVER	The pin for constant V _{CC} voltage
19	OUT1N	Output2P
20	OUT1P	Output2N

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Maximum Supply Voltage V_{CC}		V_{CC}	18	V
Maximum Output Current		I_{OUT}	50	mA
Maximum Output Withstand Voltage		V_{OUT}	18	V
Maximum HB Output Current		HB	10	mA
Maximum V_{TH} Input Pin Withstand Voltage		V_{TH}	8	V
Maximum RD/FG Output Pin Output Withstand Voltage		F_G	18	V
Maximum RD/FG Output Current		F_G	10	mA
Junction Temperature		T_J	+150	$^{\circ}\text{C}$
Allowable Power Dissipation	Mounted on a specified board (Note 2)	P_D	800	mW
Junction Temperature		T_J	+150	$^{\circ}\text{C}$
Operating Temperature		T_{OPR}	-30 ~ +95	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^{\circ}\text{C}$

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Mounted on a specified board (114.3mm×76.1mm×1.6mm, Glass epoxy).

■ RECOMMENDED OPERATING RANGE ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
V_{CC} Supply Voltage		V_{CC}	6 ~ 16	V
V_{TH} Input Level Voltage Range	Full Speed Mode	V_{TH}	0 ~ 7	V
Hall Input Common Phase Input Voltage Range		V_{ICM}	0.2 ~ 3.0	V

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	θ_{JA}	156	$^{\circ}\text{C}/\text{W}$

■ ELECTRICAL CHARACTERISTICS ($T_A=25^{\circ}\text{C}$, $V_{CC}=12\text{V}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Circuit Current	I_{CC1}	During Drive	6	10	14	mA
	I_{CC2}	During Lock Protection	6	10	14	mA
6VREG Voltage	$6V_{REG}$	$I_{6VREG}=5\text{mA}$	5.80	6.0	6.15	V
VOVER Voltage	V_{OVER}		12.0	12.8	13.6	V
CPWM-H Voltage	V_{CRH}		4.35	4.55	4.75	V
CPWM-L Voltage	V_{CRL}		1.45	1.65	1.85	V
CPWM Oscillation Frequency	F_{PWM}	$C=100\text{pF}$	8	15	22	kHz
CT Pin H Voltage	V_{CTH}		3.4	3.6	3.8	V
CT Pin L Voltage	V_{CTL}		1.4	1.9	2.2	V
ICT Pin Charge Current	I_{CT1}		1.6	2.0	2.5	μA
ICT Pin Discharge Current	I_{CT2}		0.16	0.20	0.28	μA
ICT Charge/Discharge Current Ratio	R_{CT}		8	10	12	deg
OUT-N Output Voltage	V_{ON}	$I_O=20\text{mA}$	4	10		V
OUT-P Sink Current	I_{OP}		15	20		mA
Sensitivity of Hall Input	V_{HN}	Zero Peak Value (Including Offset and Hysteresis)		10	20	mV
RD/FG Output Pin L Voltage	V_{FG}	$I_{FG}=5\text{mA}$		0.15	0.3	V
RD/FG Output Pin Leak Current	I_{FGL}	$V_{FG}=16\text{V}$			30	μA

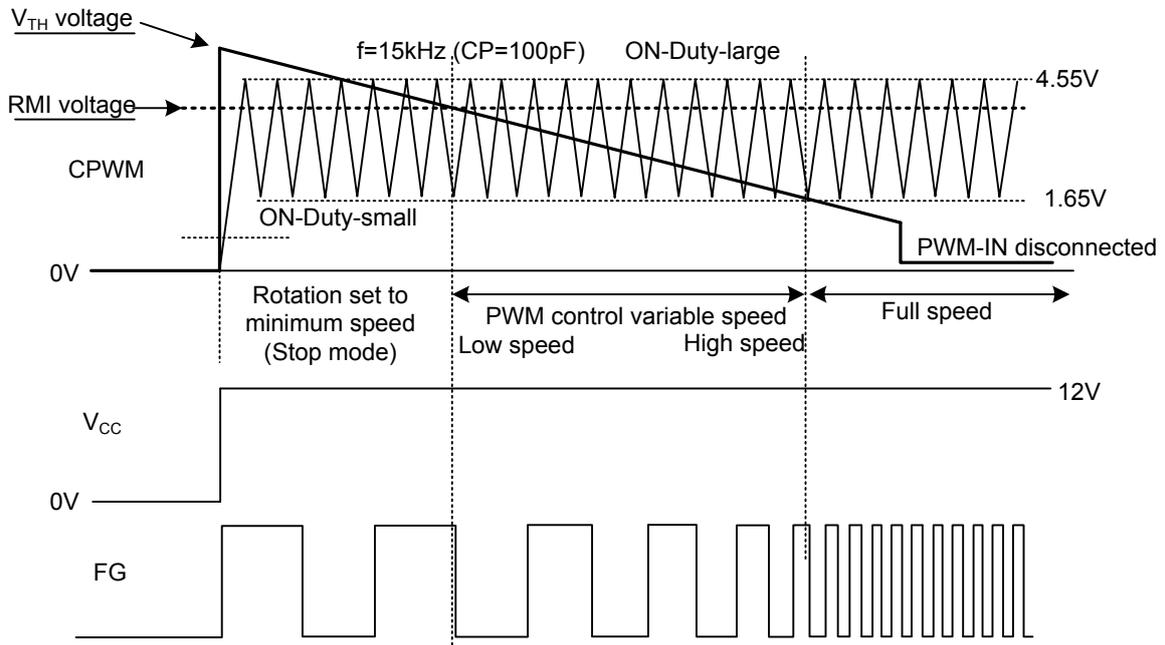
■ TRUTH TABLE

During full-speed rotation

IN-	IN+	CT	OUT1P	OUT1N	OUT2P	OUT2N	FG	RD	Mode
H	L	L	L	-	-	H	L	L	OUT1→2 drive
L	H	-	-	H	L	-	OFF	-	OUT2→1 drive
H	L	H	OFF	-	-	H	L	OFF	Lock Protection
L	H		-	H	OFF	-	OFF	-	-

V _{TH}	CPWM	IN-	IN+	OUT1P	OUT1N	OUT2P	OUT2N	Mode
L	H	H	L	L	-	-	H	OUT1→2 drive
		L	H	-	H	L	-	OUT2→1 drive
H	L	H	L	OFF	-	-	H	During Rotation Regeneration in Lower TR
		L	H	-	H	OFF	-	

■ CONTROL TIMING CHART



(1) Minimum speed setting (stop) mode

Input of PWM-IN is filtered to generate the V_{TH} voltage. At low speed, the fan rotates with the minimum speed set with RMI pin during low speed. If the minimum speed is not set ($RMI=6VREG$), the fan stops.

(2) Low \leftrightarrow High speed mode

PWM control is made through comparison of oscillation and V_{TH} voltages with CPWM changing between 1.6V \leftrightarrow 4.6V.

When the V_{TH} voltage is lower, the IC switches to drive mode. When the V_{TH} voltage is higher, the p-channel FET is turned off and coil current is regenerated through the low-side FET. Therefore, as the V_{TH} voltage lowers, the output ON-DUTY increases, increasing the coil current and raising the motor speed.

The rotation speed is fed back by the FG output.

(3) Full speed mode

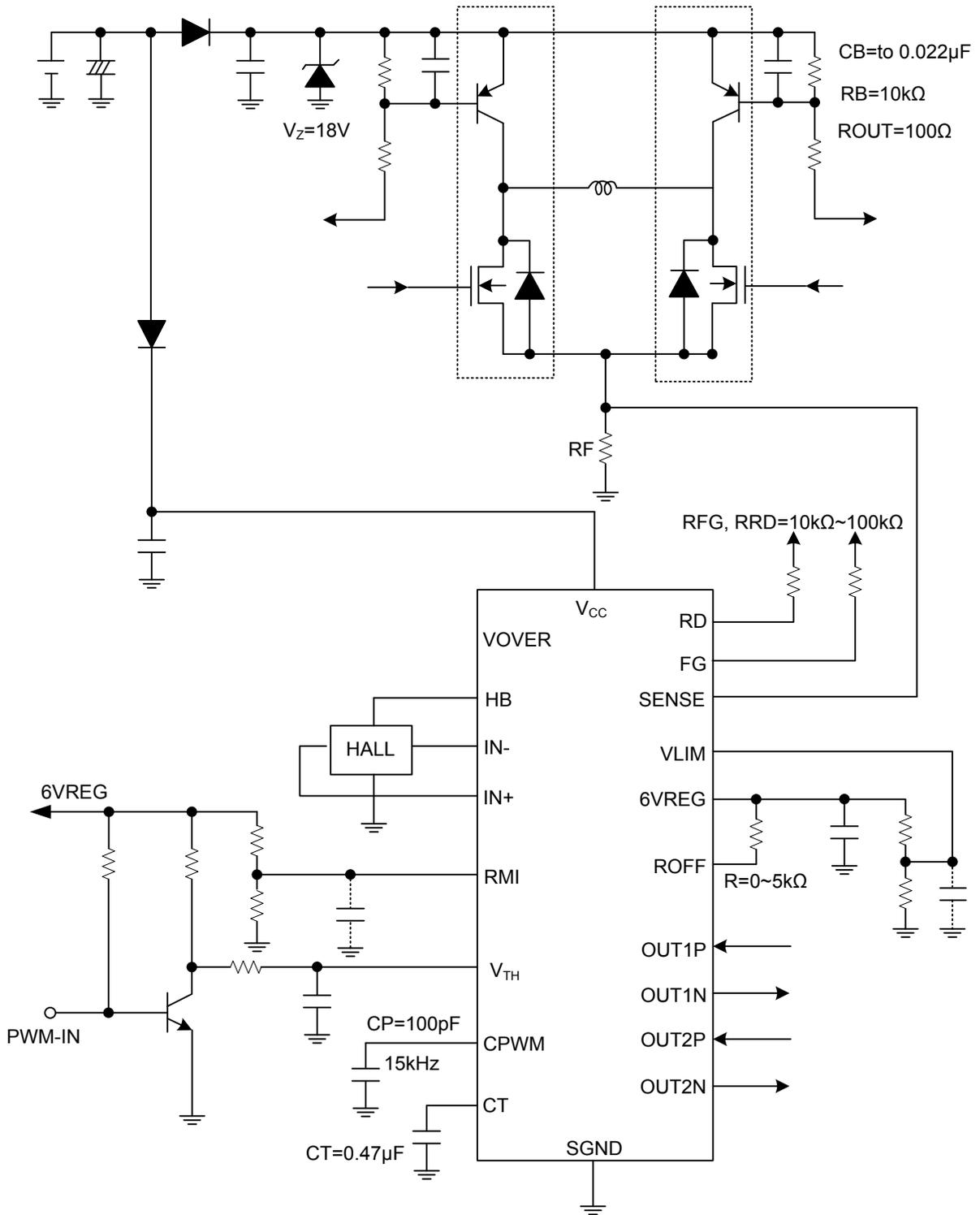
The full-speed mode becomes effective with the V_{TH} voltage of 1.65V or less. (V_{TH} must be equal to GND when the speed control is not to be made.)

(4) PWM-IN input disconnection mode

While the input pin of PWM-IN is disconnected, V_{TH} becomes 1.65V or less and the output enables full drive at 100%. The fan runs at full speed. (Refer to the sample application circuit.)

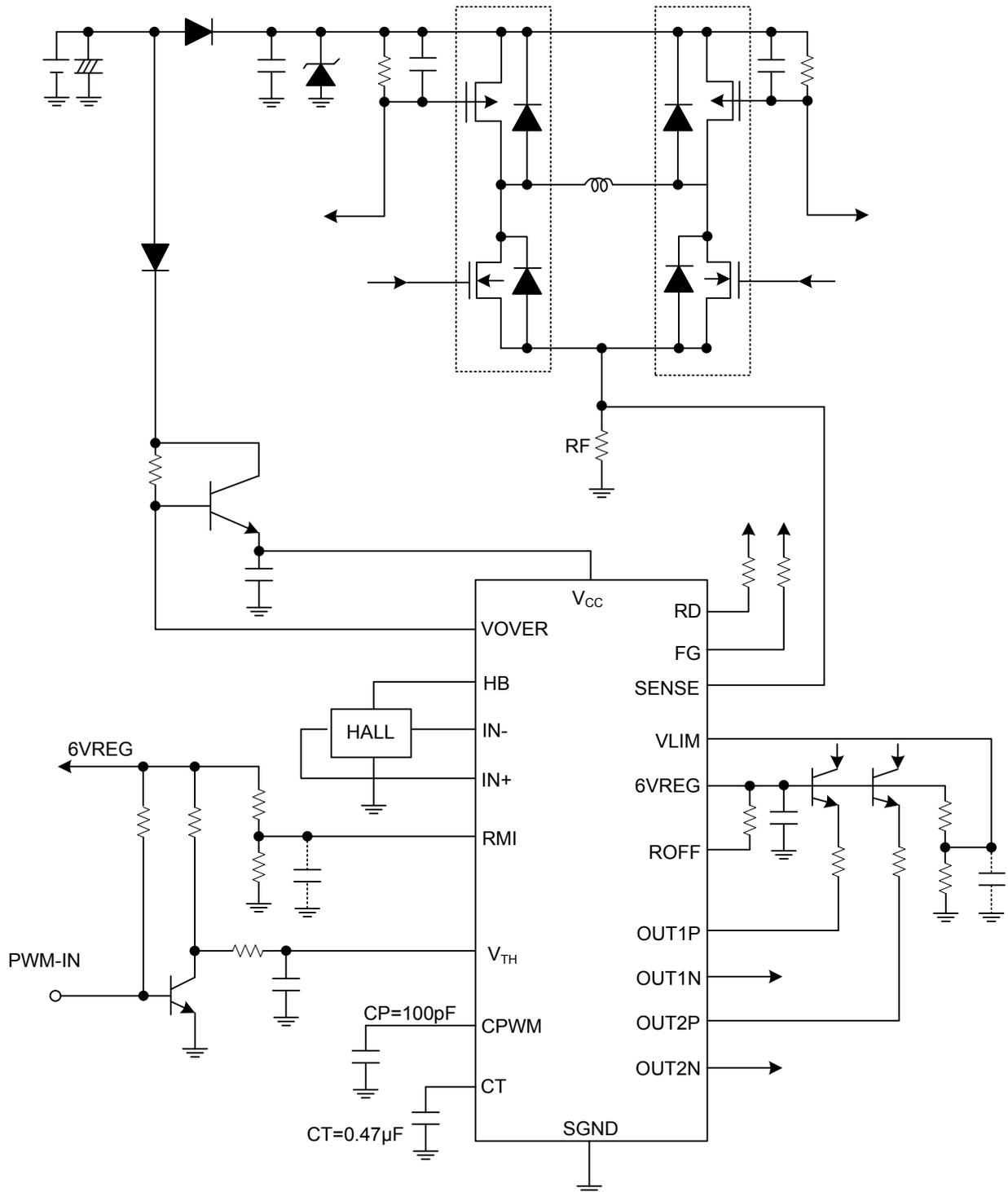
■ TYPICAL APPLICATION CIRCUIT

12V Sample Application Circuit

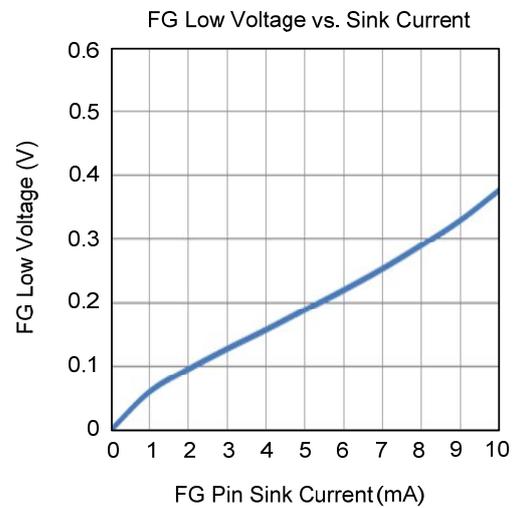
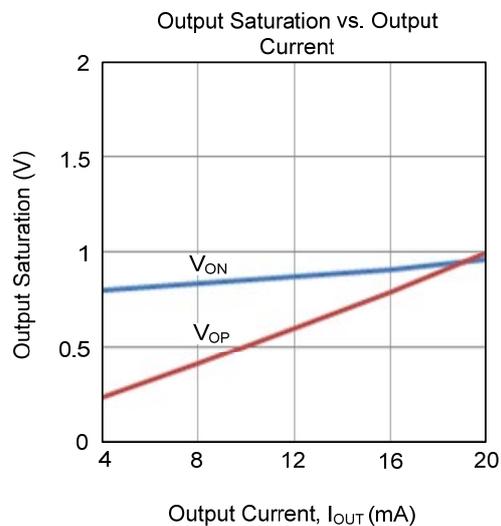
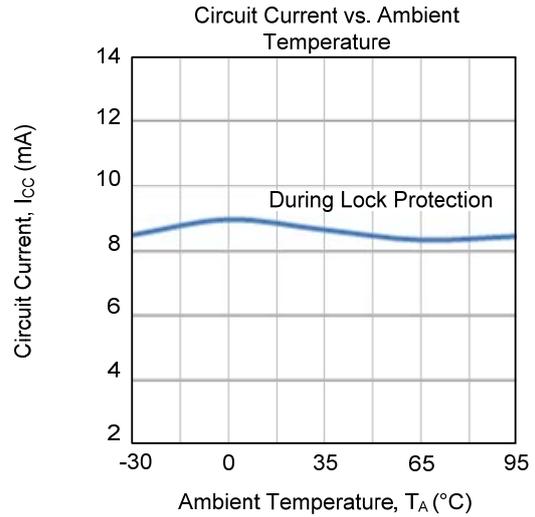
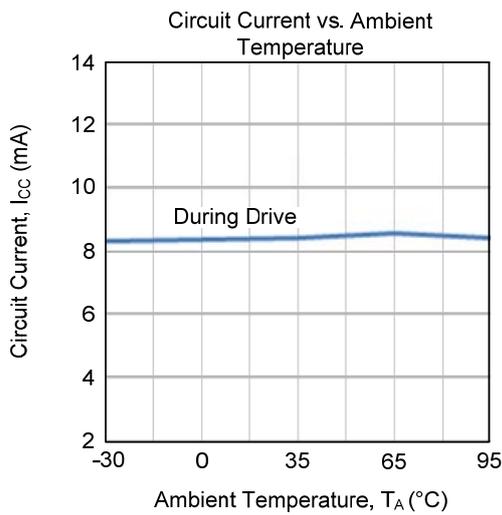
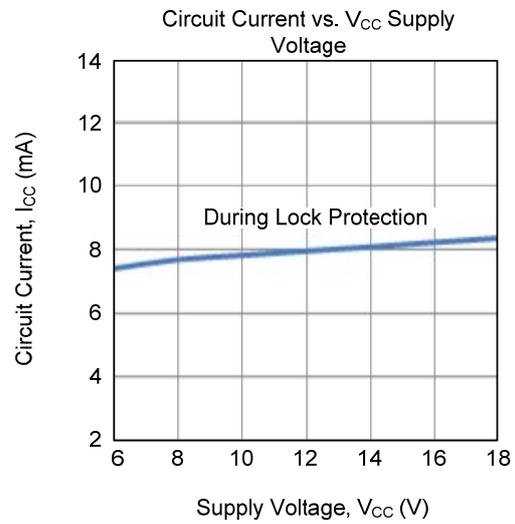
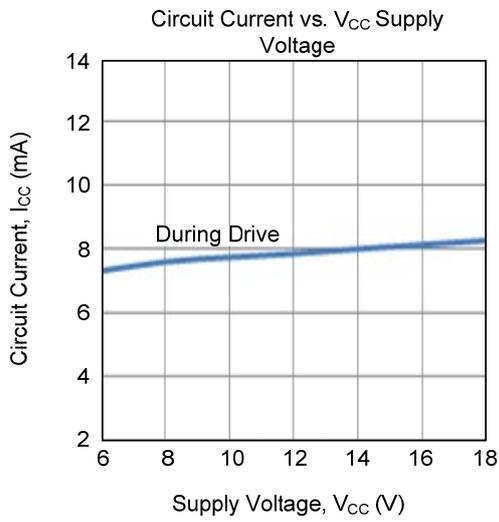


■ TYPICAL APPLICATION CIRCUIT(Cont.)

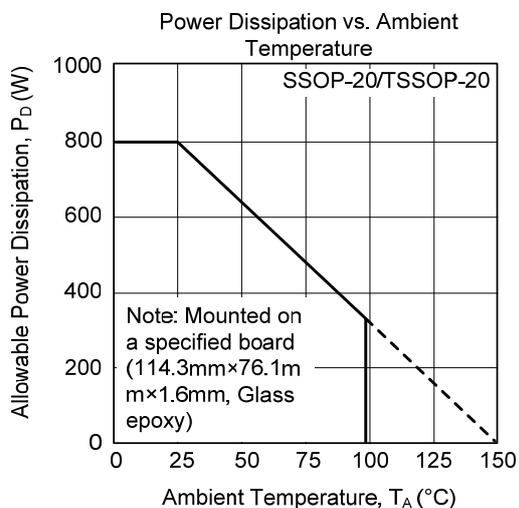
24V, 48V Sample Application Circuit



■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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