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FAIRCHILD™

November 2014

FAN7085_GF085
High Side Gate Driver with Recharge FET

Features

- Qualified to AEC Q100
- Floating channel designed for bootstrap operation fully operational up to 300V.
- Tolerance to negative transient voltage on VS pin
- dv/dt immune.
- Gate drive supply range from 4.5V to 20V
- Under-voltage lockout
- CMOS Schmitt-triggered inputs with pull-down and pull-up
- High side output out of phase with input (Inverted input)
- Reset input
- Internal recharge FET for bootstrap refresh

Typical Applications

- Diesel and gasoline injectors/valves
- MOSFET-and IGBT high side driver applications

For Fairchild's definition of "green" Eco Status, please visit:
http://www.fairchildsemi.com/company/green/rohs_green.html

Description

The FAN7085_GF085 is a high-side gate drive IC with reset input and built-in recharge FET. It is designed for high voltage and high speed driving of MOSFET or IGBT, which operates up to 300V. Fairchild's high-voltage process and common-mode noise cancellation technique provide stable operation in the high side driver under high-dV/dt noise circumstances. Logic input is compatible with standard CMOS outputs. The UVLO circuits prevent from malfunction when VCC and VBS are lower than the specified threshold voltage. It is available with space saving SOIC-8 Package. Minimum source and sink current capability of output driver is 250mA and 250mA. Built-in recharge FET to refresh bootstrap circuit is very useful for circuit topology requiring switches on low and high side of load.
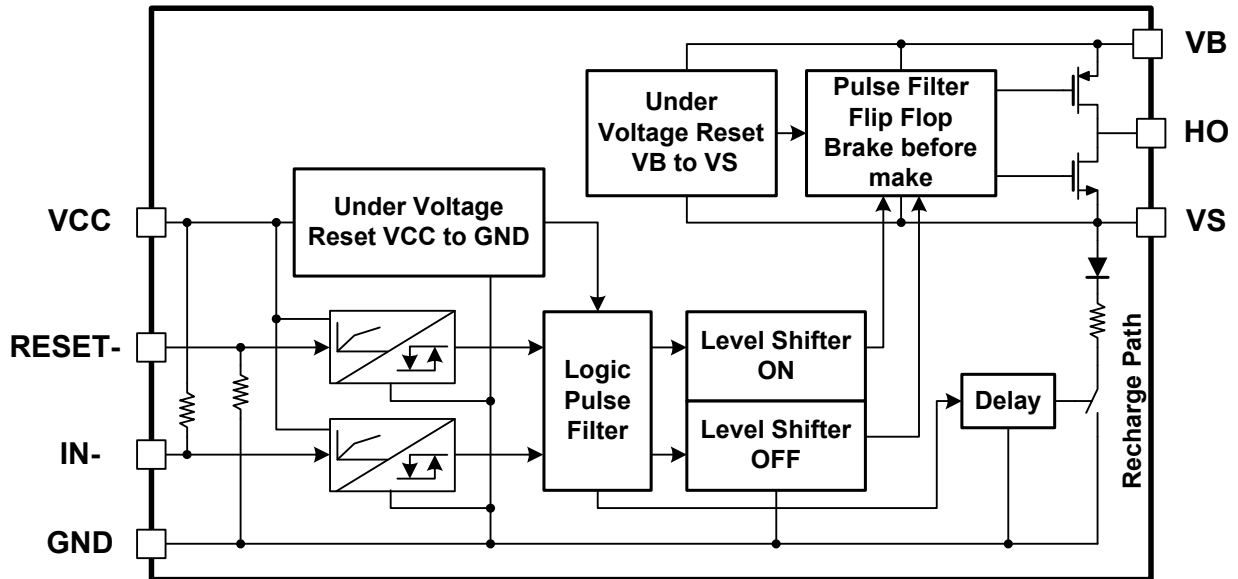
SOIC-8
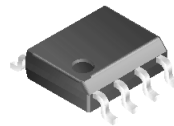
Ordering Information

Device	Package	Operating Temp.
FAN7085M_GF085	SOIC-8	-40 °C ~ 125 °C
FAN7085MX_GF085	SOIC-8	-40 °C ~ 125 °C

X : Tape & Reel type

Block Diagrams

Pin Assignments
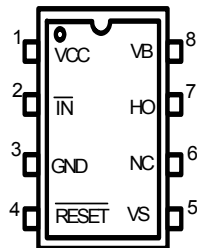
Pin Definitions

Pin Number	Pin Name	I/O	Pin Function Description
1	VCC	P	Driver supply voltage, typically 5V
2	IN-	I	Driver control signal input (Negative Logic)
3	GND	P	Ground
4	RESET-	I	Driver enable input signal (Negative Logic)
5	VS	P	High side floating offset for MOSFET Source connection
6	NC	-	No connection (No Bond wire)
7	HO	A	High side drive output for MOSFET Gate connection
8	VB	P	Driver output stage supply

Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to GND.

Parameter	Symbol	Min.	Max.	Unit
High side floating supply voltage	V_{BS}	-0.3	25	V
High side driver output stage voltage Neg. transient: 0.5 ms, external MOSFET off	V_B	-5	325	V
High side floating supply offset voltage Neg. transient 0.2 us	V_S	-25	300	V
High side floating output voltage	V_{HO}	VS-0.3	VB+0.3	V
Supply voltage	V_{CC}	-0.3	25	V
Input voltage for IN-	V_{IN}	-0.3	Vcc+0.3	V
Input voltage for RESET-	V_{RES}	-0.3	Vcc+0.3	V
Power Dissipation [1]	P_d		0.625	W
Thermal resistance, junction to ambient [1]	R_{thja}		200	°C/W
Electrostatic discharge voltage (Human Body Model)	V_{ESD}	1.5K		V
Charge device model	V_{CDM}	500		V
Junction Temperature	T_j		150	°C
Storage Temperature	T_S	-55	150	°C

Note: 1) The thermal resistance and power dissipation rating are measured bellow conditions;
        JESD51-2: Integrated Circuit Thermal Test Method Environmental Conditions - Natural condition(StillAir)
        JESD51-3: Low Effective Thermal Conductivity Test Board for Leaded Surface Mount Package

Recommended Operating Conditions

For proper operation the device should be used within the recommended conditions.-40°C <= Ta <= 125°C

Parameter	Symbol	Min.	Max.	Unit
High side floating supply voltage(DC) Transient:-10V@ 0.2 us	V_B	VS+4.5	VS+20	V
High side floating supply offset voltage(DC) @VBS=7V	V_S	-3	300	V
High side floating supply offset voltage(Transient) 0.2us @VBS<25V	V_S	-25	300	V
High side floating output voltage	V_{HO}	Vs	VB	V
Allowable offset voltage Slew Rate [1]	dv/dt	-	50	V/ns
Supply voltage for logic part	V_{CC}	4.5	20	V
Input voltage for IN-	V_{IN}	0	Vcc	V
Input voltage for RESET-	V_{RESET}	0	Vcc	V
Switching frequency [2]	F_s		200K	Hz
Minimum low input width [3]	$t_{IN(low,min)}$	560	-	ns
Minimum high input width [3]	$t_{IN(high,min)}$	60	-	ns
Minimum operating voltage of VB related to GND	$V_{B(MIN)}$ [4]	4	-	V
Ambient temperature	T_a	-40	125	°C

Note: 1) Guaranteed by design.
     2) Duty = 0.5, VBS >=7V
     3) Guaranteed by design. Pulse widths below the specified values, may be ignored. Output will either follow the input signal or will ignore it.
       No false output state is guaranteed when minimum input width is smaller than tin
     4) Guaranteed by design

Statics Electrical Characteristics

Unless otherwise specified, -40°C <= Ta <= 125°C, VCC = 5V, VBS = 7V, VS = 0V, VRESET = 5V, RL = 50Ω, CL = 2.5nF.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
VCC and VBS Supply Characteristics						
VCC and VBS supply under voltage positive going threshold	VCCUV+ VBSUV+	VCC and VBS rising from 0V	-	3.7	4.3	V
VCC and VBS supply under voltage negative going threshold	VCCUV- VBSUV-	VCC and VBS dropping from 5V	2.8	3.4	-	V
VCC and VBS under voltage hysteresis	VCCUVH VBSUVH	-	0.02	0.3	-	V
Under voltage lockout response time	tduvcc tduvbs	VCC: 6.5V->2.4V or 2.4V->6.5V VBS: 6.5V->2.4V or 2.4V->6.5V	0.5 0.5		20 20	us us
Offset supply leakage current	ILK	VB=VS=300V	-	-	200	uA
Quiescent Vcc supply current	IQCC	Vcc=20V	-	-	500	uA
Quiescent VBS supply current	IQBS1	Static mode, VBS=7V, VIN=0 or 5V			100	uA
Quiescent VBS supply current	IQBS2	Static mode, VBS=16V, VIN=0 or 5V			200	uA
VBS drop due to output turn-on (Design guaranty)	∆VBS	VBS=7V, Cbs=1uF, tdIG-IN =3uS, tTEST=100uS			210	mV
Input Characteristics						
High logic level input voltage for IN-	VIH		0.6VCC	-	-	V
Low logic level input voltage for IN-	VIL		-	-	0.28VCC	V
Low logic level input bias current for IN-	IIN-	VIN=0	5	25	60	uA
High logic level input bias current for IN-	IIN+	VIN=5V	-	-	5	uA
Full up resistance at IN	RIN		83	200	1000	KΩ
High logic level input voltage for RESET-	VRH		0.6Vcc	-	-	V
Low logic level input voltage for RESET-	VRL				0.28Vcc	V
High logic level input current for RESET-	IRES+	VRESET=5V	5	25	60	uA
Low logic level input bias current for RESET-	IRES-	VRESET=0			5	uA
Full down resistance at RESET-	RRES		83	200	1000	KΩ
Output characteristics						
High level output voltage, VB - VHO	VOH	IO=0	-	-	0.1	V
Low level output voltage, VHO-GND	VOL	IO=0	-	-	0.1	V
Peak output source current	IO+	VIN=5V	250	450	-	mA
Peak output sink current	IO-	VIN=0	250	450	-	mA
Equivalent output resistance	ROP			15.5	28	Ω
	RON			15.5	28	Ω
Recharge Characteristics						
Recharge TR turn-on propagation delay	Ton_rech		4	7.9	9.8	us
Recharge TR turn-off propagation delay	Toff_rech			0.2	0.4	us
Recharge TR on-state voltage drop	VRECH	Is=1mA, VIN=5V @125°C			1.2	V
Dead Time Characteristics						
High side turn-off to recharge gate turn-on	DTHOFF	Vcc=5V, VS=7V	4	7.8	9.8	us
Recharge gate turn-off to high side turn-on	DTHON	Vcc=5V, VS=7V	0.1	0.4	0.7	us

Note: The input parameter are referenced to GND. The VO and IO parameters are referenced to GND.

Dynamic Electrical Characteristics

Unless otherwise specified, -40°C <= Ta <= 125°C, VCC = 5V, VBS = 7V, VS = 0V, VRESET = 5V, RL = 50Ω, CL = 2.5nF.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input-to-output turn-on propagation delay	tplh	50% input level to 10% output level, VS = 0V		0.56	1	us
Input-to-output turn-off propagation delay	tphl	50% input level to 90% output level VS = 0V	-	0.15	0.5	us
RESET-to-output turn-off propagation delay	tphl_res	50% input level to 90% output level	-	0.17	0.5	us
RESET-to-output turn-on propagation delay	tplh_res	50% input level to 10% output level	-	0.56	1	us
Output rising time	tr1	Tj=25°C	-	65	200	ns
	tr2			-	400	ns
	tr3	Tj=25°C,VBS=16V		65	200	ns
	tr4	VBS=16V		-	400	ns
Output falling time	tf1	Tj=25°C	-	25	200	ns
	tf2			-	300	ns
	tf3	Tj=25°C,VBS=16V		25	200	ns
	tf4	VBS=16V		-	300	ns

Application Information

1. Logic Tables

VCC	VBS	RESET-	IN-	Ho	RechFET
< VCCUVLO-	X	X	X	OFF	ON
X	X	LOW	X	OFF	ON
X	X	X	HIGH	OFF	ON
> VCCUVLO+	> VBSUVLO+	HIGH	LOW	ON	OFF
> VCCUVLO+	< VBSUVLO-	HIGH	LOW	OFF	OFF

Notes:

X means independent from signal

IN-=LOW indicates that the high side NMOS is ON

IN-=HIGH indicates that the high side NMOS is OFF

RechFET =ON indicates that the recharge MOSFET is ON

RechFET =OFF indicates that the recharge MOSFET is OFF

Typical Application Circuit

1. Typical Application Circuit
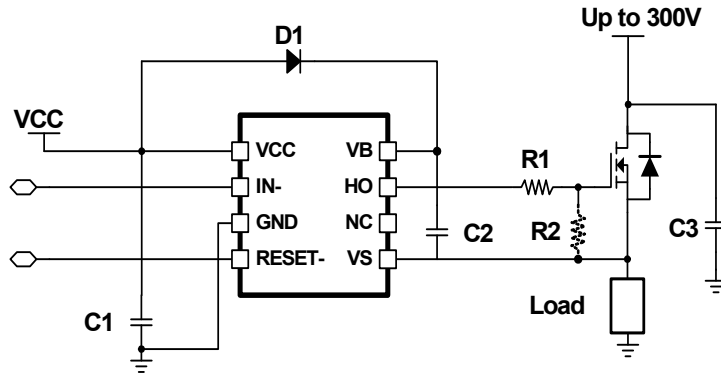
2. Application Example
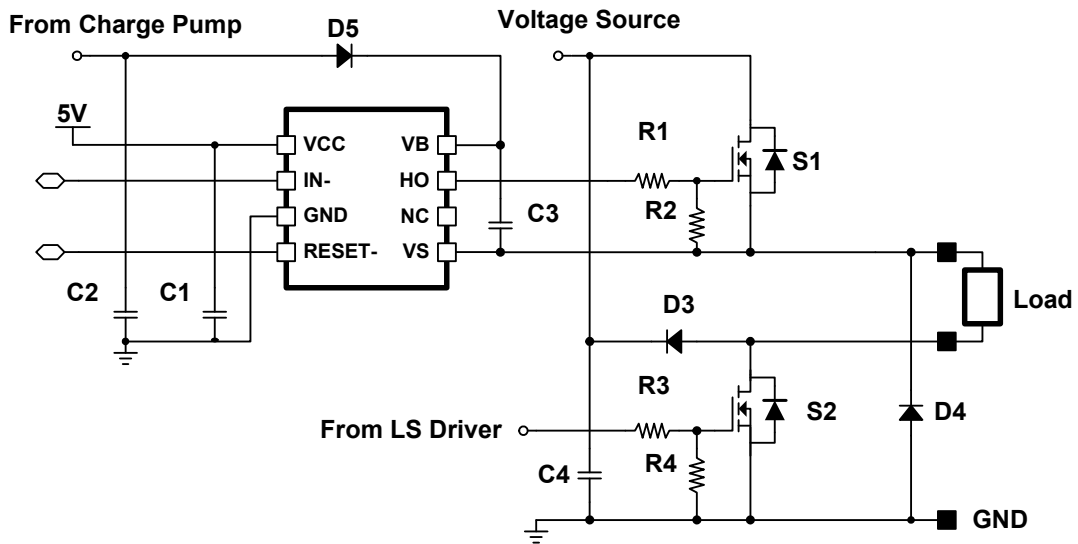
Input-Output Waveforms

1. Input/Output Timing Diagrams
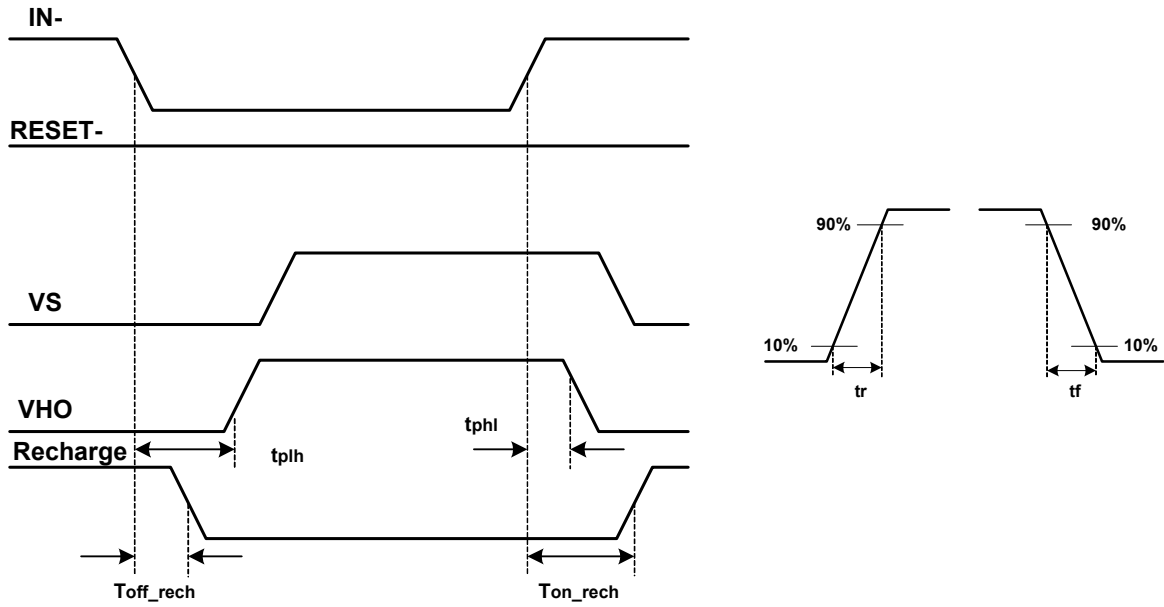
Figure.1 Input and Output Timing Diagram and Switching Time Waveform Definition

2. Reset Timing Diagrams
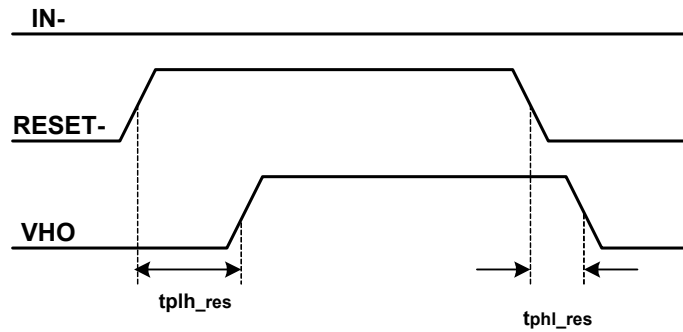
Figure.2 Reset and Output Timing Diagram

3.VB Drop Voltage Diagram
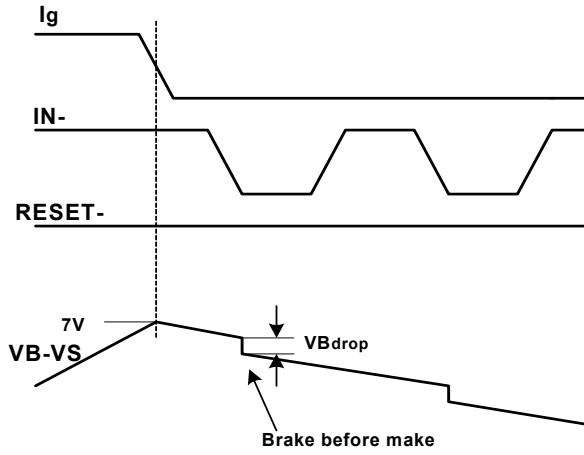
Figure3.a VB Drop Voltage Diagram
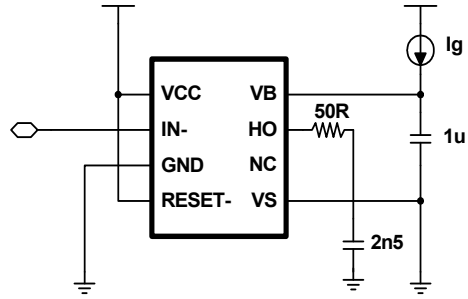
Figure3.b VB Drop Voltage Test Circuit

4.Recommendation Min. Short Pulse Width
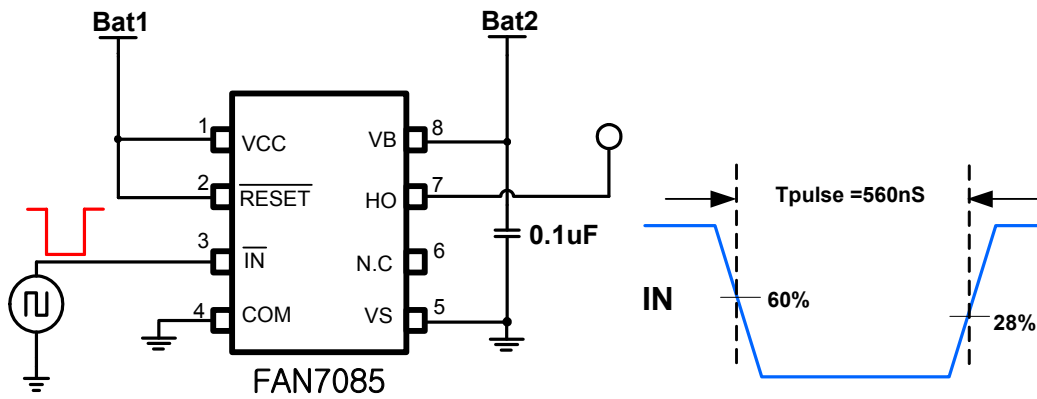
Figure 4a.Short Pulse Width Test Circuit and Pulse Width Waveform
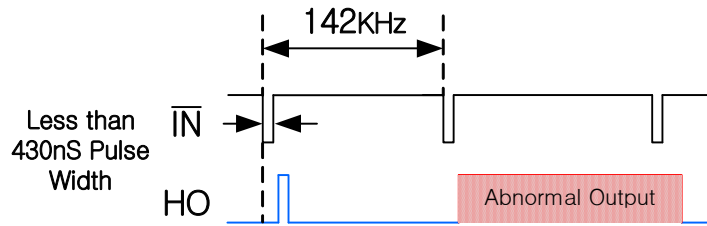
Figure 4b. Abnormal Output Waveform with short pulse width
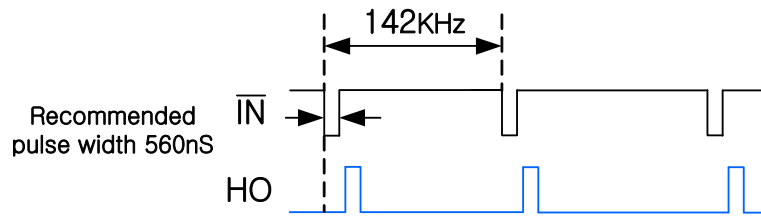
Figure 4c. Recommendation of pulse width Output Waveform

Performance Graphs

This performance graphs based on ambient temperature -40°C ~125°C
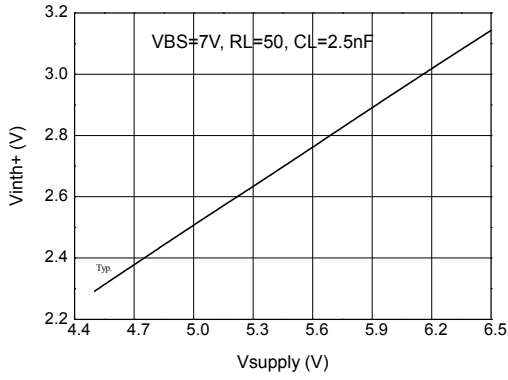
Figure 5a. Positive IN and RESET Threshold vs VCC Supply
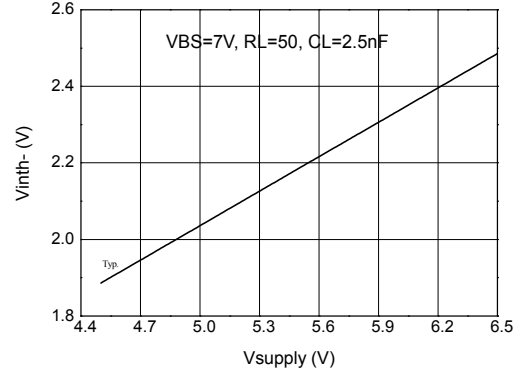
Figure 5b. Negative IN and RESET Threshold vs VCC Supply
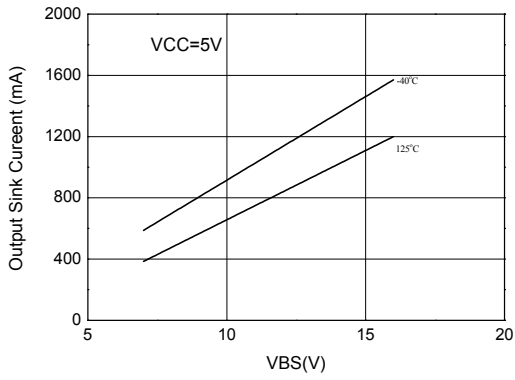
Figure6a. Output Sink Current vs VBS Supply
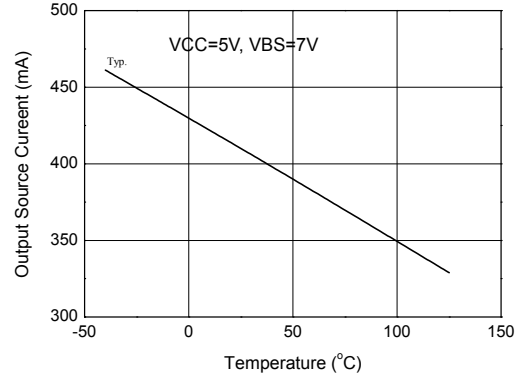
Figure6b. Output Source Current vs Temperature
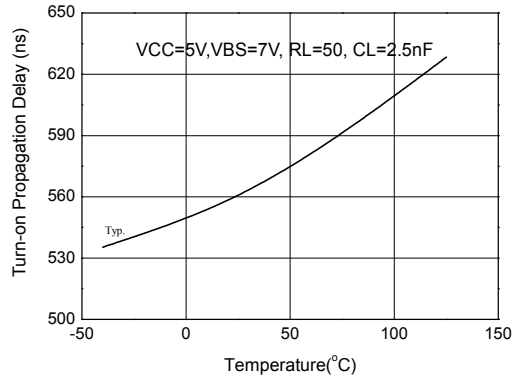
Figure 7a. Turn-On Propagation Delay Time vs Temperature
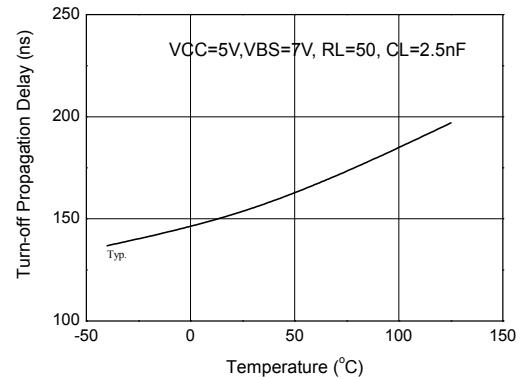
Figure 7b. Turn-Off Propagation Delay Time vs Temperature

RES-to-Output Turn-on Propagation Delay (ns)

700

650

600

550

500

VCC=5V, VBS=7V, RL=50, CL=2.5nF

Typ.

-50   0   50   100   150
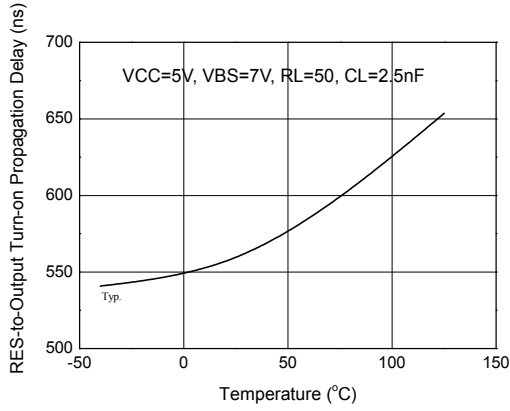
Temperature (°C)

Figure 8a. RES to Output Turn-On Propagation Delay vs Temperature

RES-to-Output Turn-off Propagation Delay (ns)

250

200

150

100

VCC=5V, VBS=7V, RL=50, CL=2.5nF

Typ.

-50   0   50   100   150
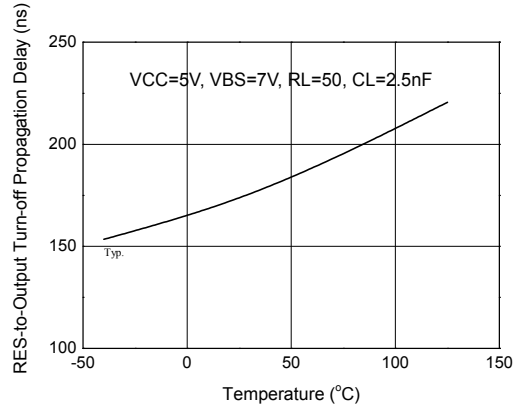
Temperature (°C)

Figure 8b. RES to Output Turn-Off Propagation Delay vs Temperatur

Logic "0" Input Current (uA)

50

40

30

20

10

0

VCC=5V, RL=50, CL=2.5nF

Typ.

-50   0   50   100   150
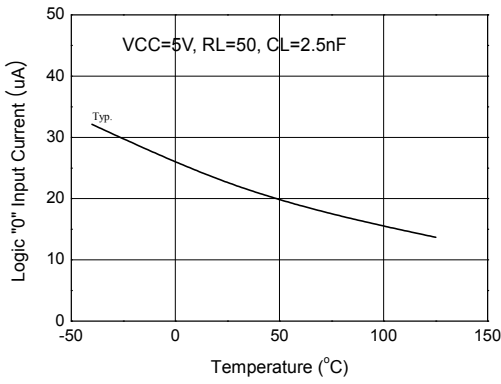
Temperature (°C)

Figure 9. Logic "0" IN Input Current vs Temperature

Logic "1" RES Input Current (uA)

50

40

30

20

10

0

VCC=5V, RL=50, CL=2.5nF

Typ.

-50   0   50   100   150
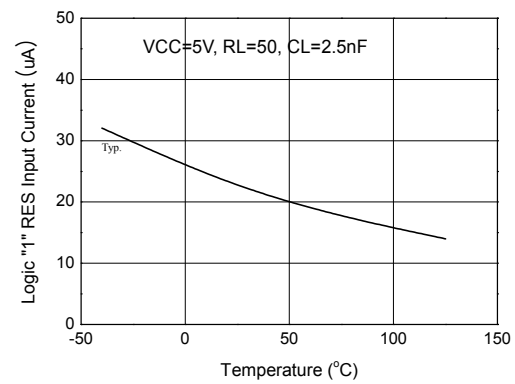
Temperature (°C)

Figure 10. Logic "1" RESET Input Current vs Temperature

V_{BS} Supply Voltage(V)

5.0

4.5

4.0

3.5

3.0

2.5

2.0

Max.

Typ.

Min.

-50   0   50   100   150
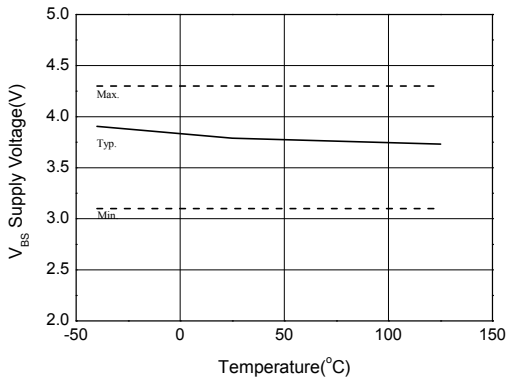
Temperature(°C)

Figure 11a. VBS Under Voltage Threshold(+) vs Temperature

V_{BS} Supply Voltage(V)

5.0

4.5

4.0

3.5

3.0

2.5

2.0

Max.

Typ.

Min.

-50   0   50   100   150
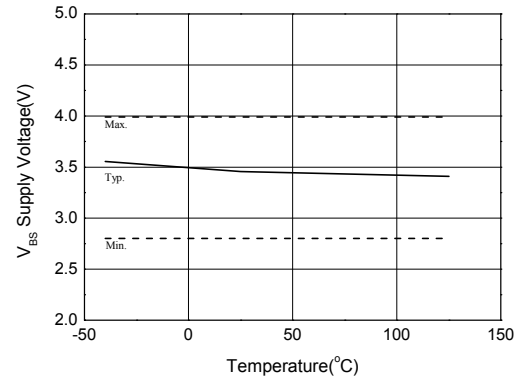
Temperature(°C)

Figure 11b. VBS Under Voltage Threshold(-) vs Temperature
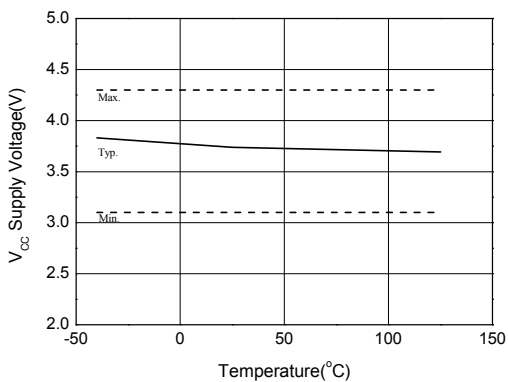
Figure 12a. VCC Under Voltage Threshold(+) vs Temperature
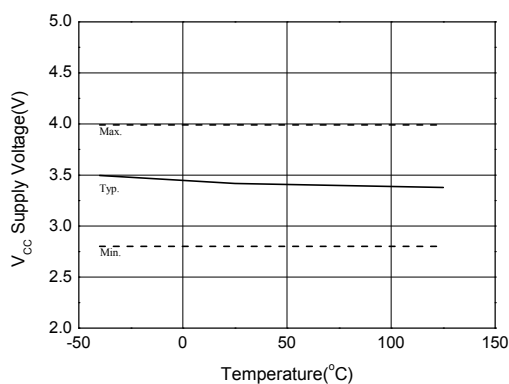
Figure 12b. VCC Under Voltage Threshold(-) vs Temperature
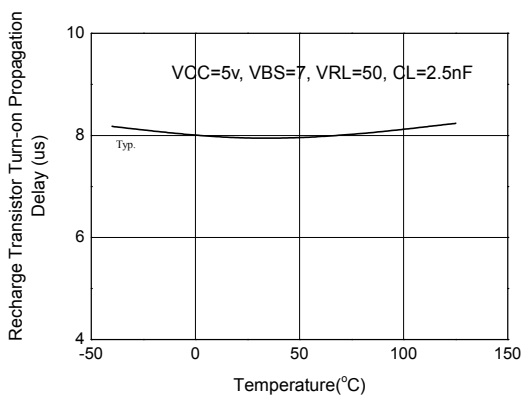
Figure 13. Recharge FET Turn-on Delay time
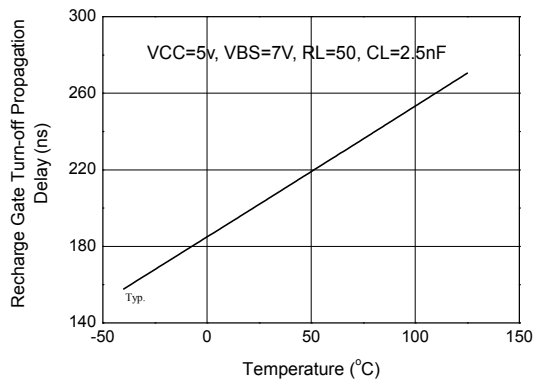
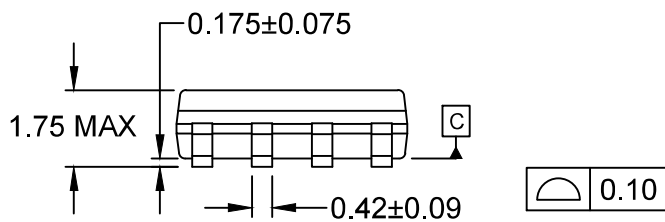**Figure 14. Recharge FET Turn-off Delay time**
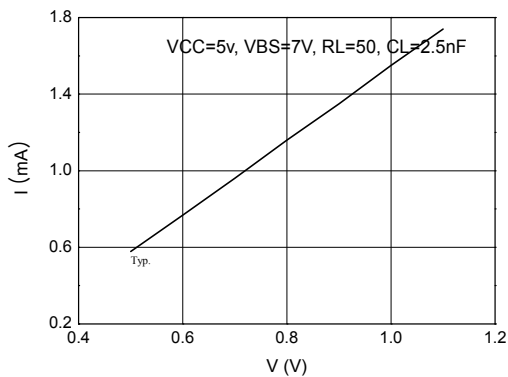
Figure 15. Recharge FET I-V curve
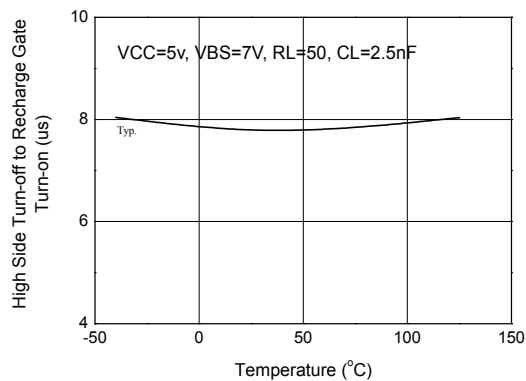
Figure 16. High Side Turn-off to Recharge FET turn-on VS Temperature

4.90±0.10 A

(0.635)

8   5

B

6.00±0.20   3.90±0.10

PIN ONE
INDICATOR

1   4

1.27

⌖ 0.25Ⓜ C B A

0.65

1.75

5.60

1.27

LAND PATTERN RECOMMENDATION

0.175±0.075

1.75 MAX

C

0.42±0.09

⌒ 0.10

SEE DETAIL A

0.22±0.03

OPTION A - BEVEL EDGE

OPTION B - NO BEVEL EDGE

(0.86) x 45°

R0.10   GAGE PLANE

R0.10

0.36

8°
0°

0.65±0.25

SEATING PLANE

(1.04)

DETAIL A
SCALE: 2:1
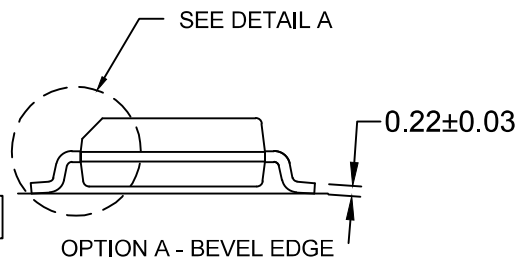
NOTES:

A) THIS PACKAGE CONFORMS TO JEDEC
     MS-012, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE MOLD
     FLASH OR BURRS.
D) LANDPATTERN STANDARD: SOIC127P600X175-8M
E) DRAWING FILENAME: M08Arev16

FAIRCHILD.

PUBLICATION ORDERING INFORMATION

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