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Electronic Ignition Control Circuit

The 79076, in conjunction with an appropriate Freescale Power Darlington Transistor, provides an economical solution for automotive ignition applications. The 79076 offers optimum performance by providing closed loop operation of the Power Darlington in controlling the ignition coil current.

Features

- Hall or Variable Reluctance Sensor Input
- Ignition Coil Voltage Internally Limited to 375 V
- Coil Current Limiting to 7.5 A
- Output On–Time (Dwell) Control
- Dwell Feedback Control to Sense Coil Variation
- Pb-Free Packaging Designated by Suffix Code EG

79076

ELECTRONIC IGNITION CONTROL CIRCUIT

DW SUFFIX
EG (PB-FREE) SUFFIX
98ASB42567B
16-PIN SOIC

ORDERING INFORMATION

Device	Temperature Range (T_A)	Package
MC79076DW/R2	-30°C to 125°C	16 SOIC
MCZ79076EG/R2		
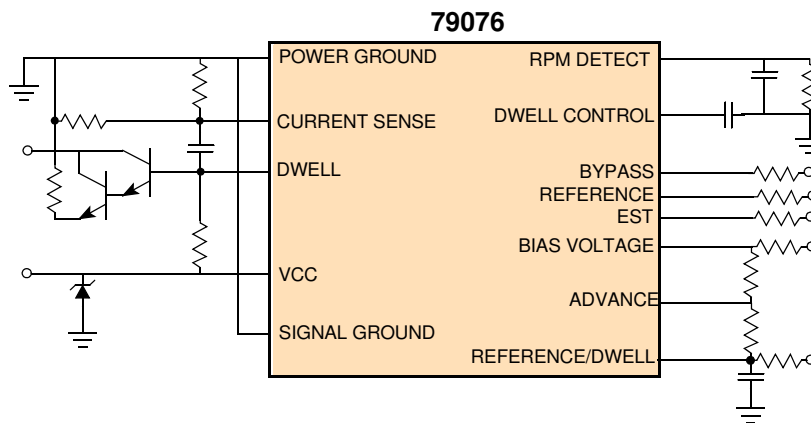
Figure 1. 79076 Simplified Application Diagram

freescale™
semiconductor

INTERNAL BLOCK DIAGRAM
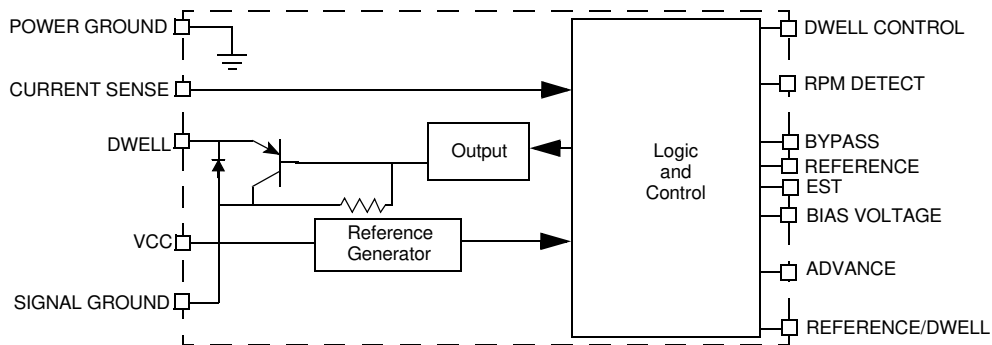
Figure 2. 79076 Simplified Internal Block Diagram

PIN CONNECTIONS
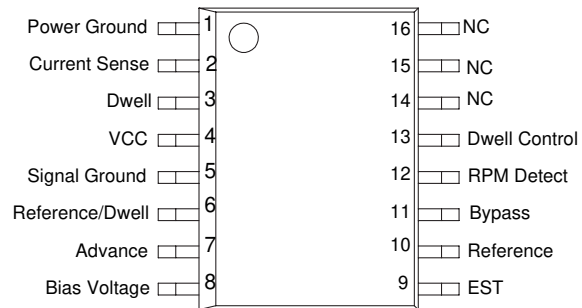
Figure 3. 79076 Pin Connections

Power Ground — 1	16 — NC
Current Sense — 2	15 — NC
Dwell — 3	14 — NC
VCC — 4	13 — Dwell Control
Signal Ground — 5	12 — RPM Detect
Reference/Dwell — 6	11 — Bypass
Advance — 7	10 — Reference
Bias Voltage — 8	9 — EST

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ELECTRICAL CHARACTERISTICS

Table 1. Maximum Ratings

All voltages are with respect to ground unless otherwise noted. Exceeding these ratings may cause a malfunction or permanent damage to the device.

Ratings	Symbol	Value	Unit
ELECTRICAL RATINGS			
Supply Voltage			V
Steady-State	$V_{CC(SUS)}$	36	
Transient Conditions [1]	$V_{CC(PK)}$	50	
Supply Current	I_T		
Transient Conditions [2]		1.0	A
Transient Negative Current (t_T = 60ms)		-100	mA
Transient Negative Current (t_T = 1ms)		-1.3	A
Input Voltage [3]			V
Ref/Dwell, Advance	V_{IN1}	-5.0 to 30	
EST, Bypass	V_{IN2}	-5.0 to 24	
Ref/Dwell Input Current	I_{IN1}	-20	mA
Dwell ON Sink Current	I_D		A
Output ON (Operating)		0.3	
Output ON (t = 10ms)		0.8	
Dwell OFF Voltage [4]	$V_{D(OFF)}$	5.0	V
THERMAL RATINGS			
Storage Temperature	T_{STG}	-65 to 150	°C
Operating Ambient Temperature	T_A	-30 to 125	°C
THERMAL RESISTANCE			
Operating Junction Temperature	T_J	-30 to 150	°C
Thermal Resistance (Junction-to-Ambient) - SO8	$\varnothing_{J-A}$	80	°C/W
Peak Package Reflow Temperature During Reflow [5], [6]	T_{PPRT}	Note 6	°C

Notes

1. Survivability of device with transient voltage applied to V_{CC} pin for a duration not to exceed 10ms.

2. Survivability of device with overvoltage applied to V_{CC} pin producing the current for a duration not to exceed 10ms.

3. Exceeding this voltage range on the function pin may cause permanent damage to the device.

4. A zener diode is incorporated across collector to emitter of the output NPN device to prevent voltage overdrive of the external Darlington switch transistor.

5. Pin soldering temperature limit is for 10 seconds maximum duration. Not designed for immersion soldering. Exceeding these limits may cause malfunction or permanent damage to the device.

6. Freescale's Package Reflow capability meets Pb-free requirements for JEDEC standard J-STD-020C. For Peak Package Reflow Temperature and Moisture Sensitivity Levels (MSL),
    Go to www.freescale.com, search by part number [e.g. remove prefixes/suffixes and enter the core ID to view all orderable parts. (i.e. MC33xxxD enter 33xxx), and review parametrics.

STATIC ELECTRICAL CHARACTERISTICS

Table 2. Static Electrical Characteristics

Characteristics noted under conditions $7.0\ V \leq V_{CC} \leq 18\ V$, $-40°C \leq T_A \leq 125°C$, GND = 0 V unless otherwise noted. Typical values noted reflect the approximate parameter means at $T_A = 25°C$ under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
INPUTS					
Advance Input Resistance (V_{CC} = 16 V, Ref/Dwell = 1.0 V, Advance = 1.0 mA, EST = Bypass = 0 V)	$R_{(A)}$	15	18	25	kΩ
Advance Voltage [7] V_{CC} = 16 V, Ref/Dwell = 1.0 V, EST = Bypass = 0 V	$V_{TH(A)}$	-	0.05	0.1	V
Advance Threshold Voltage [7] (V_{CC} = 16 V, Ref/Dwell = 1.0 V, EST = Bypass = 0 V,) Dwell = Reference = RPM Detect = open, Dwell Control = sinking 10 μA) Increasing Decreasing Hysteresis	$V_{TH+(A)}$ $V_{TH-(A)}$ $V_{HYS(A)}$	$V_B + 0.103$ $V_B + 0.045$ 0.018	$V_B + 0.114$ $V_B + 0.068$ 0.045	$V_B + 0.130$ - -	V
Bypass Input Resistance (V_{CC} = 16 V, Ref/Dwell = Advance = 3.0, EST = Bypass = 0 V)	$R_{(BP)}$	6.0	9.2	16	kΩ
Bypass Voltage (V_{CC} = 16 V, Ref/Dwell = Advance = 1.0 V, EST = 0V)	$V_{(BP)}$	-	0.065	0.1	V
Bypass Threshold Voltage [8] (Ref/Dwell = Advance = 1.0 V, EST = 3.0 V) Increasing Decreasing Hysteresis	$V_{TH+(BP)}$ $V_{TH-(BP)}$ $V_{HYS(BP)}$	$V_B + 1.6$ $V_B + 0.9$ 0.65	$V_B + 0.188$ $V_B + 0.103$ 0.86	$V_B + 2.1$ - -	V
Current Sense Threshold Voltage [9] (V_{CC} = 16 V, Ref/Dwell = Advance = 1.0 V, EST = Bypass = 3.0 V)	$V_{TH(CS)}$	90	105	121	mV
EST Input Resistance (V_{CC} = 16 V, Ref/Dwell = Advance = 1.0 V, Bypass = 3.0 V)	$R_{(EST)}$	7.0	10.3	18	kΩ
EST Input Voltage (EST Mode) (V_{CC} = 16 V, Ref/Dwell = Advance = 1.0 V, Bypass = 3.0 V)	$V_{(EST)}$	-	0.07	0.1	V

Notes

7. Advance Threshold Voltage is the positive (or negative) going voltage on Advance necessary cause the Dwell Control voltage to positive (or negative) going transition 2.0 V respectively. It is expressed as $V_{TH\pm(A)} = V_B + V_X$ where V_B is the Bias Voltage and V_X is the additional voltage necessary to attain the threshold.

8. Bypass Threshold Voltage is the positive (or negative) going voltage on Bypass necessary cause the Dwell voltage to positive (or negative) going transition 1.5 V respectively. It is expressed as $V_{TH\pm(BP)} = V_B + V_X$ where V_B is the Bias Voltage and V_X is the additional voltage necessary to attain the threshold.

9. Increasing voltage on Current Sense which when attained will cause Dwell to transition low to 1.5 V with a 10 mA load.

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Table 2. Static Electrical Characteristics (continued)

Characteristics noted under conditions $7.0\ V \leq V_{CC} \leq 18\ V$, $-40°C \leq T_A \leq 125°C$, GND = 0 V unless otherwise noted. Typical values noted reflect the approximate parameter means at $T_A = 25°C$ under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
EST Threshold Voltage [10] (Ref/Dwell = Advance = 1.0 V, Bypass = 3.0 V) Increasing Decreasing Hysteresis	$V_{TH+(EST)}$ $V_{TH-(EST)}$ $V_{HYS(EST)}$	1.65 0.8 0.79	1.86 0.89 0.97	2.0 - -	V
Ref/Dwell Current [11] (V_{CC} = 16 V, Advance = 1.0 V, EST = Bypass = 0 V) Ref/Dwell Voltage = 1.0 V Ref/Dwell Voltage = 20 V	$I_{(R/D)}$	 -12 -1.0	 -1.38 0.02	 1.0 5.0	µA
Ref/Dwell Clamp Voltage (V_{CC} = 16 V, Advance = 1.0 V, EST = Bypass = 0 V) $I_{R/D}$ = 100µA (Sourcing) $I_{R/D}$ = 1.0mA (Sourcing)	$V_{(R/D)CL}$	 -0.01 -0.62	 -0.04 -0.54	 0.2 -	V
Ref/Dwell Threshold (Bypass Mode) [12] (Advance = 1.0 V, EST = Bypass = 0 V, Reference = sinking 10 µA) Increasing Decreasing Hysteresis	$V_{TH+(R/D)BP}$ $V_{TH-(R/D)BP}$ $V_{HYS(R/D)BP}$	V_B + 0.09 V_B + 0.018 0.055	V_B + 0.106 V_B + 0.03 0.076	V_B + 0.116 - -	V
Ref/Dwell Threshold (EST Mode) [12] (Advance = 1.0 V, EST = 0 V, Bypass = 3.0 V, Reference = sinking 10 µA) Increasing Decreasing Hysteresis	$V_{TH+(R/D)EST}$ $V_{TH-(R/D)EST}$ $V_{HYS(R/D)EST}$	V_B + 0.445 V_B + 0.038 0.395	V_B + 0.50 V_B + 0.062 0.436	V_B + 0.535 - -	V
Ref/Dwell Threshold (No Pump) [13] (Advance = 1.0 V, EST = Bypass = 0 V, Dwell = sinking 10 mA) Increasing Decreasing Hysteresis	$V_{TH+(R/D)NP}$ $V_{TH-(R/D)NP}$ $V_{HYS(R/D)NP}$	V_B + 0.003 V_B + 0.021 V_B + 0.013	V_B + 0.118 V_B + 0.047 V_B + 0.072	V_B + 0.128 - -	V

Notes

10. EST Threshold Voltage is the positive (or negative) going voltage on EST necessary cause the Dwell voltage to positive (or negative) going transition 1.5 V respectively. It is expressed as $V_{TH\pm(EST)}$ and is in reference to ground.

11. Ref/Dwell can either source or sink current; A minus sign denotes the Ref/Dwell is sourcing current.

12. Ref/Dwell Threshold Voltage (Bypass Mode) is the positive (or negative) going voltage on Ref/Dwell necessary cause the Reference voltage to positive (or negative) going transition 1.5 V respectively. It is expressed as $V_{TH\pm(RD)} = V_B + V_X$ where V_B is the Bias Voltage and V_X is the additional voltage necessary to attain the threshold.

13. Ref/Dwell Threshold Voltage (No Pump) is the positive (or negative) going voltage on Ref/Dwell necessary cause the Dwell voltage to positive (or negative) going transition 1.5 V respectively. It is expressed as $V_{TH\pm(RD)} = V_B + V_X$ where V_B is the Bias Voltage and V_X is the additional voltage necessary to attain the threshold. Advance = 1.0 V providing no input assist or "No Pump" influence of Dwell signal; Reference open.

Table 2. Static Electrical Characteristics (continued)

Characteristics noted under conditions $7.0\ V \leq V_{CC} \leq 18\ V$, $-40°C \leq T_A \leq 125°C$, GND = 0 V unless otherwise noted. Typical values noted reflect the approximate parameter means at $T_A = 25°C$ under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
Ref/Dwell Threshold (Max Pump) [14] (V$_{CC}$ = 16 V, Advance = 3.0 V, EST = Bypass = 0 V, Dwell sinking 10 mA, Dwell Control = open)					V
Increasing	$V_{TH+(R/D)MP}$	$V_B + 0.175$	$V_B + 0.474$	$V_B + 0.80$	
Decreasing	$V_{TH-(R/D)MP}$	$V_B + 0.115$	$V_B + 0.425$	$V_B + 0.735$	
Hysteresis	$V_{HYS(R/D)MP}$	$V_B + 0.025$	$V_B + 0.048$	-	

OUTPUTS

Characteristic	Symbol	Min	Typ	Max	Unit
Bias Resistance to Ground Dwell = V$_{CC}$ = Ref/Dwell = Reference = Dwell Control = open, Advance = 1.0 V, EST = Bypass = 0 V	$R_{(B)}$	0.55	0.68	0.9	kΩ
Bias Voltage (Bypass Mode) Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V	$V_{(B)BP}$	2.25	2.43	2.6	V
Bias Voltage Regulation (Bypass Mode) Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V	$V_{(B)BP}$	-	30	40	mV
Bias Voltage (EST Mode) V$_{CC}$ = 16 V, Ref/Dwell = Advance = 1.0 V, EST = 0 V, Bypass = 3.0 V	$V_{(B)EST}$	1.9	2.04	2.2	V
Dwell Saturation Voltage	$V_{(D)SAT}$				V
V$_{CC}$ = 4.0 V, I$_D$ = 40 mA, Ref/Dwell = Advance =3.0 V, EST = Bypass = 0 V		-	0.05	0.1	
V$_{CC}$ = 16 V, I$_D$ = 160 mA, Ref/Dwell = Advance =3.0 V, EST = Bypass = 0 V		-	0.14	0.24	
V$_{CC}$ = 24 V, I$_D$ = 240 mA, Ref/Dwell = Advance =1.0 V, EST = Bypass = 3.0 V		-	0.20	0.35	
V$_{CC}$ = 36 V, I$_D$ = 360 mA, Ref/Dwell = Advance =1.0 V, EST = Bypass = 3.0 V		-	0.29	0.5	
Dwell Reverse Clamp Voltage [15]	$V_{(D)REV}$	-0.9	-0.98	-1.2	V
Dwell Leakage Current [16] V$_{CC}$ = 16 V, Dwell = 5.0 V, Ref/Dwell = Advance = 3.0 V, EST = Bypass = 0, Bias Voltage = Reference = open	$I_{(D)KG}$	-	0.044	50	µA
Reference Low [17] I$_R$ = sinking 0.3 mA, Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V	$V_{(R)LOW}$	-	0.13	0.22	V

Notes

14. Ref/Dwell Threshold Voltage (Max Pump) is the positive (or negative) going voltage on Ref/Dwell necessary cause the Dwell voltage to positive (or negative) going transition 1.5 V respectively. It is expressed as $V_{TH\pm(RD)} = V_B + V_X$ where V_B is the Bias Voltage and V_X is the additional voltage necessary to attain the threshold. Advance = 3.0 V providing maximum input assist or Max Pump" influence of Dwell signal; Reference = Dwell Control = open.
15. All pins open except Pwr Gnd with Dwell sinking 200 mA.
16. Limit conditions with Dwell output NPN in the OFF condition.
17. Reference saturation voltage to ground with 0.3mA of current going into the Reference.

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Table 2. Static Electrical Characteristics (continued)

Characteristics noted under conditions $7.0\ V \le V_{CC} \le 18\ V$, $-40°C \le T_A \le 125°C$, GND = 0 V unless otherwise noted. Typical values noted reflect the approximate parameter means at $T_A = 25°C$ under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
Reference High/Un-Clamped [27] V_{CC} = 4.0 V, I_R = sourcing 100 mA, Ref/Dwell = 3.0 V, Advance = 1.0 V, EST = Bypass = 0 V	$V_{(R)HI/UNCL}$	3.2	3.36	-	V
Reference High/Clamped [27] V_{CC} = 16 V, Ref/Dwell = 3.0 V, Advance = 1.0 V, EST = Bypass = 0 V I_R = sourcing 10 µA I_R = sourcing 1.0 mA	$V_{(R)HI/CL}$	 - 12	 5.41 15.3	 6.0 -	V

CONTROLS

Characteristic	Symbol	Min	Typ	Max	Unit
Dwell Control Negative Clamp Voltage [27] V_{CC} = 16 V, I_{DC} = sourcing 100 µA, Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V	$V_{(DC)-CL}$	0.5	0.7	0.8	V
Dwell Control Positive Clamp Voltage [27] V_{CC} = 16 V, I_{DC} = sinking 100 µA, Ref/Dwell = 1.0 V, Advance = Open, EST = Bypass = 0 V	$V_{(DC)+CL}$	8.0	8.2	8.4	V
Dwell Control Charge Current [27] V_{CC} = 16 V, Ref/Dwell = 1.0 V, Advance = Dwell Control = 3.0 V, EST = Bypass = 0 V	$I_{(DC)CHG}$	30	47	58	µA
Dwell Control Discharge Current [27] V_{CC} = 16 V, Current Sense = 0.5 V, Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V	$I_{(DC)DISCHG}$	18	33	48	µA
Dwell Control Input Current [27] V_{CC} = 16 V, Ref/Dwell = Advance = 1.0 V, EST = Bypass = 0 V, Dwell Control = 7.0 V	$I_{(DC)SINK}$	-	1.1	2.5	µA
RPM Detect Charge Current ON [27] V_{CC} = 16 V, Ref/Dwell = 3.0 V, Advance = 1.0 V, EST = Bypass = 0 V	$I_{(RPM)CHG}$	-4.0	0.54	1.0	mA
RPM Detect Current [27] V_{CC} = 16 V, 1.0 V = Ref/Dwell = Advance = 3.0 V, EST = Bypass = 0 V RPM Detect = 0.5 V RPM Detect = 1.5 V	$I_{(RPM)LKG}$	 04.0 -0.1	 0.55 0.01	 1.0 0.1	µA
RPM Detect Clamp Voltage [27] V_{CC} = 16 V, Ref/Dwell = 3.0 V, Advance = 1.0 V, EST = Bypass = 0 V, RPM Detect = sourcing 16 µA	$V_{(RPM)CL}$	2.4	2.5	2.7	V

Notes
18. Dwell Control adjusts the reference voltage of Dwell Comparator.
19. Dwell Control. sourcing 100 µA.
20. Dwell Control sinking 100 µA.
21. Dwell Control at 3.0 V; Internal Dwell Control transistor OFF.
22. Dwell Control at 3.0 V; Internal Dwell Control transistor ON.
23. Dwell Control at 7.0 V; Internal Dwell Control transistor OFF.
24. Q53 and Q54 both ON; Measured with RPM Detect voltage at 0.5 V to reflect maximum source current capability. See Typical Applications on page 10
25. Q53 and Q54 both OFF; Measured with RPM Detect voltage at 0.5 V and 1.5 V to reflect maximum leakage current. Typical Applications on page 10
26. Q53 and Q54 both ON; RPM Detect sinking 16 µA. Typical Applications on page 10

Table 2. Static Electrical Characteristics (continued)

Characteristics noted under conditions $7.0\ V \le V_{CC} \le 18\ V$, $-40°C \le T_A \le 125°C$, $GND = 0\ V$ unless otherwise noted. Typical values noted reflect the approximate parameter means at $T_A = 25°C$ under nominal conditions unless otherwise noted.

Characteristic	Symbol	Min	Typ	Max	Unit
RPM Detect Threshold [27] V_{CC} = 16 V, Ref/Dwell = Advance = 3.0 V, EST = Bypass = 0 V	$V_{TH-(RPM)}$	0.8	0.92	1.0	V
RPM Detect Charge Current V_{CC} = 16 V, Ref/Dwell = 3.0 V, Advance = 1.0 V, EST = Bypass = 0 V	$I_{(RPM)CHG}$	-	-2.0	-	mA

Notes

27. Decreasing Threshold; RPM Detect voltage decreased from 0.6 V until Dwell voltage transitions low to 1.5 V with 10 mA load.

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TYPICAL APPLICATIONS

Analog Integrated Circuit Device Data
Freescale Semiconductor
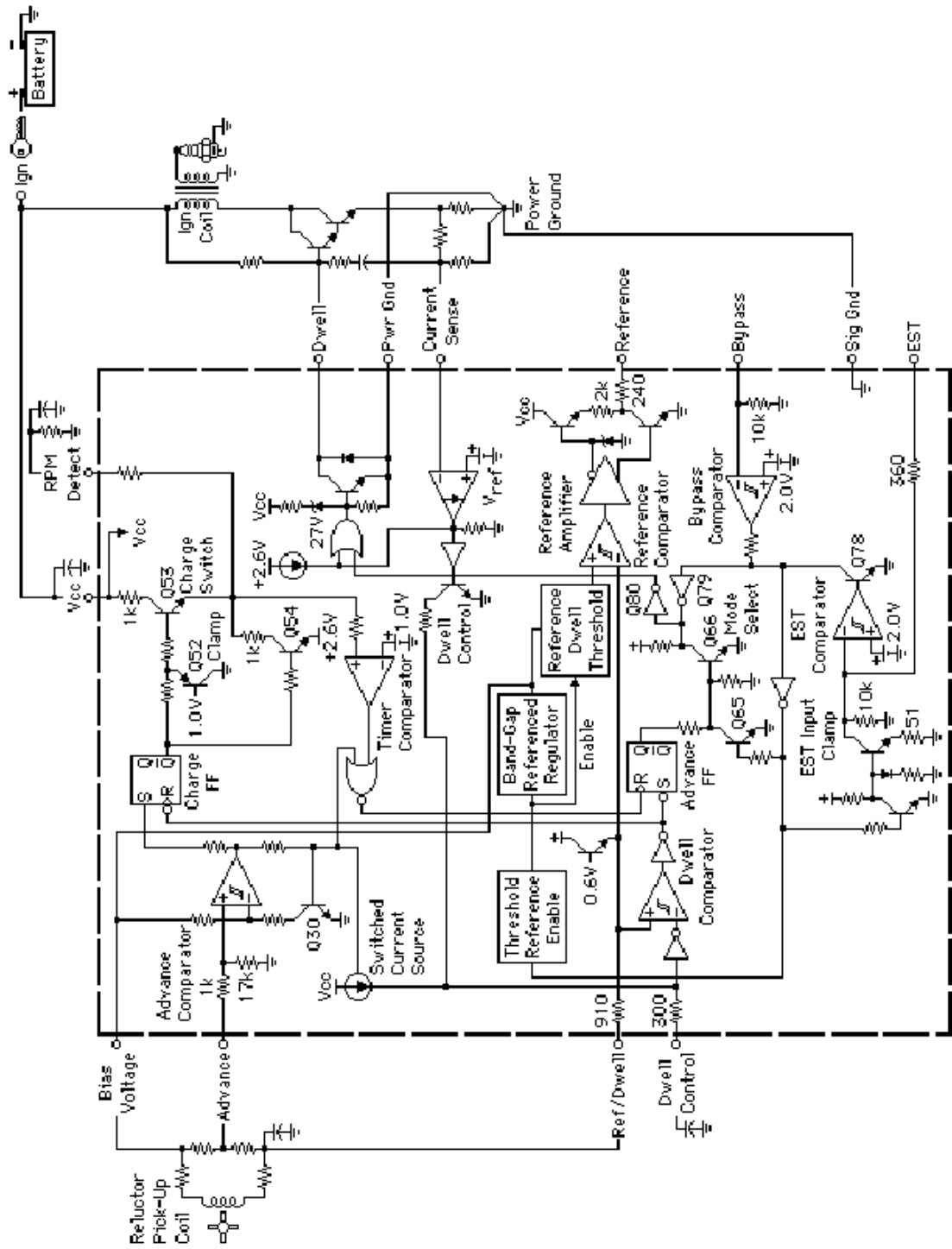
PACKAGING

PACKAGE DIMENSIONS

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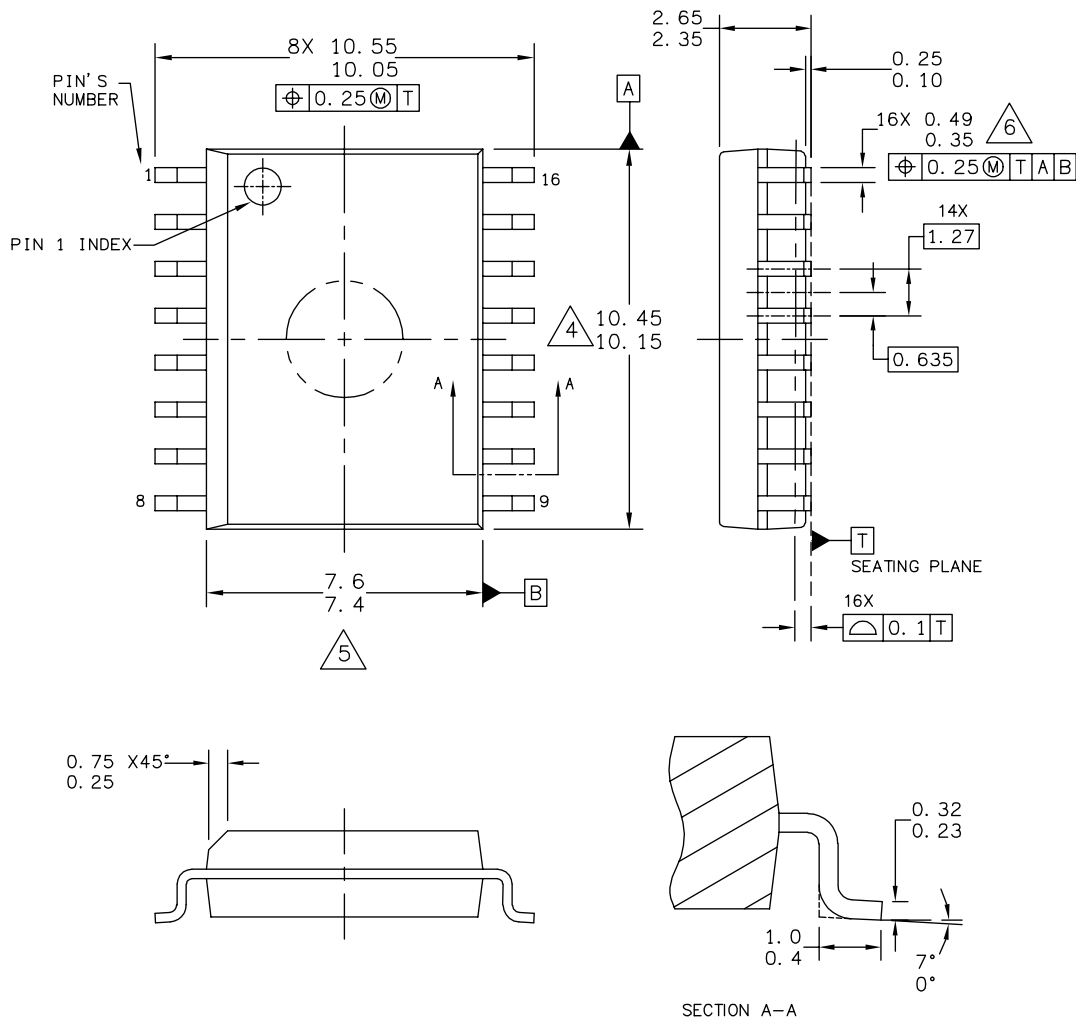
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	CASE NUMBER: 751G-04	02 JUN 2005	
	STANDARD: JEDEC MS-013AA		

DW SUFFIX
EG SUFFIX (PB-FREE)
16-PIN
PLASTIC PACKAGE
98ASB42567B
ISSUE F

79076

REVISION HISTORY

REVISION	DATE	DESCRIPTION OF CHANGES
3.0	3/2007	• Implemented Revision History page • Converted to Freescale format • Added MCZ79076EG/R2 to the Ordering Information • Removed MCCF79076 and all corresponding references.

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