

LOW POWER OFF-LINE PRIMARY SIDE REGULATION CONTROLLER

Description

The AP3775H is a high performance AC/DC power supply controller for battery charger and adapter applications. It can meet less than 10mW standby power for “Super Star” charger criteria. The device uses Pulse Frequency Modulation (PFM) method to build discontinuous conduction mode (DCM) flyback power supplies.

The AP3775H provides accurate constant voltage (CV), constant current (CC) and outstanding dynamic performance without requiring an opto-coupler. It also eliminates the need of loop compensation circuitry while maintaining stability.

The AP3775H achieves excellent regulation and high average efficiency, less than 10mW no-load power consumption, less than 1s startup time for 10mW standby power solutions and less than 0.5s startup time for 30mW standby power solutions. When AP3775H is used with AP4341 series, good under-shoot performance and higher conversion efficiency can be achieved.

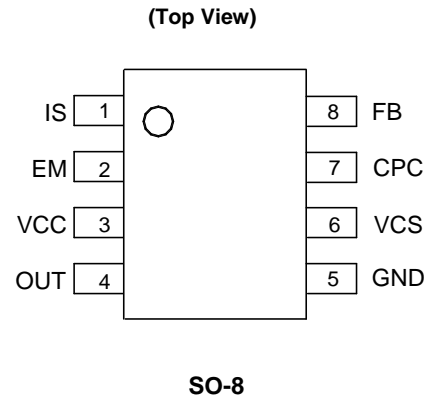
The AP3775H is available in SO-8 package.

Features

- Primary Side Control for Eliminating Opto-coupler
- 10mW No-load Input Power
- Compensation for External Component Temperature Variations
- Flyback Topology in DCM Operation
- Random Frequency Adjustment to Reduce System EMI
- Built-in Soft Start
- Over Voltage Protection
- Over Temperature Protection
- Short Circuit Protection
- AP4341 Series Awakening Signal Detection
- Audio Noise Reduction
- Internal Cable Compensation
- SO-8 Package
- **Totally Lead-free & Fully RoHS Compliant (Note 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**

Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, “Green” and Lead-free.
3. Halogen- and Antimony-free “Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

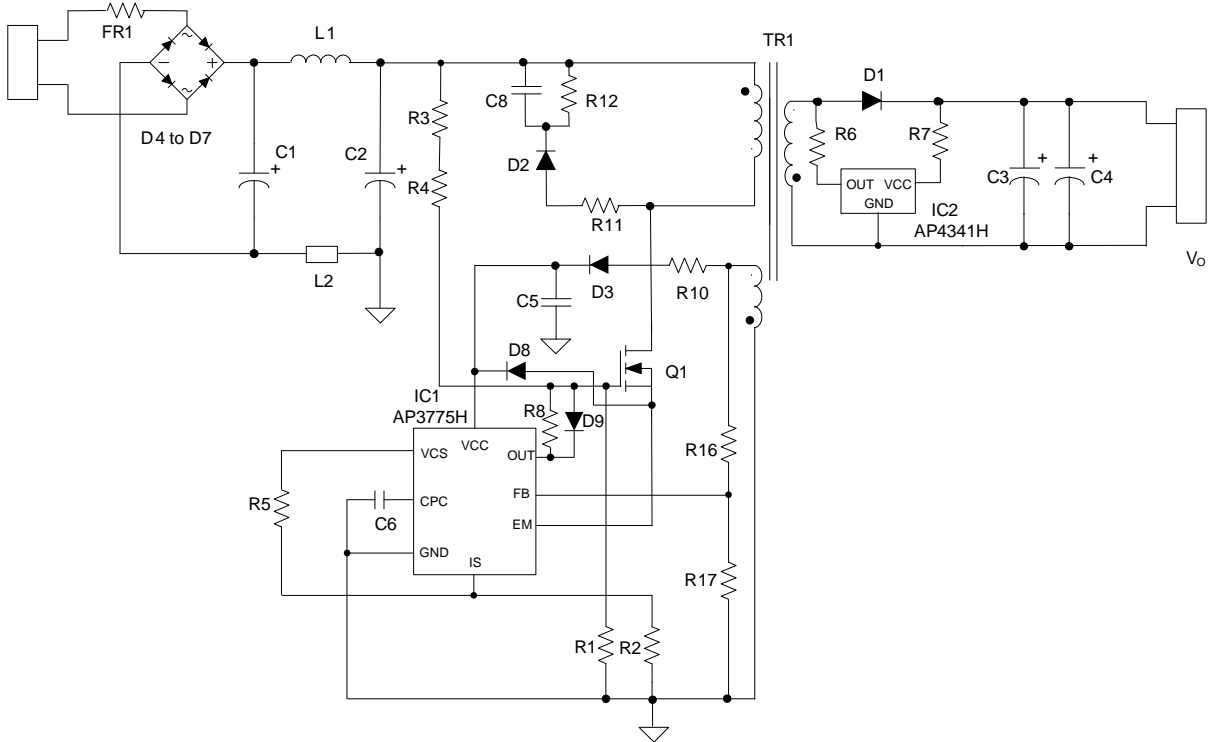
Pin Assignments



Applications

- Adapter/Chargers for Shaver, Cell/Cordless Phones, PDAs, MP3 and Other Portable Apparatus
- Standby and Auxiliary Power Supplies

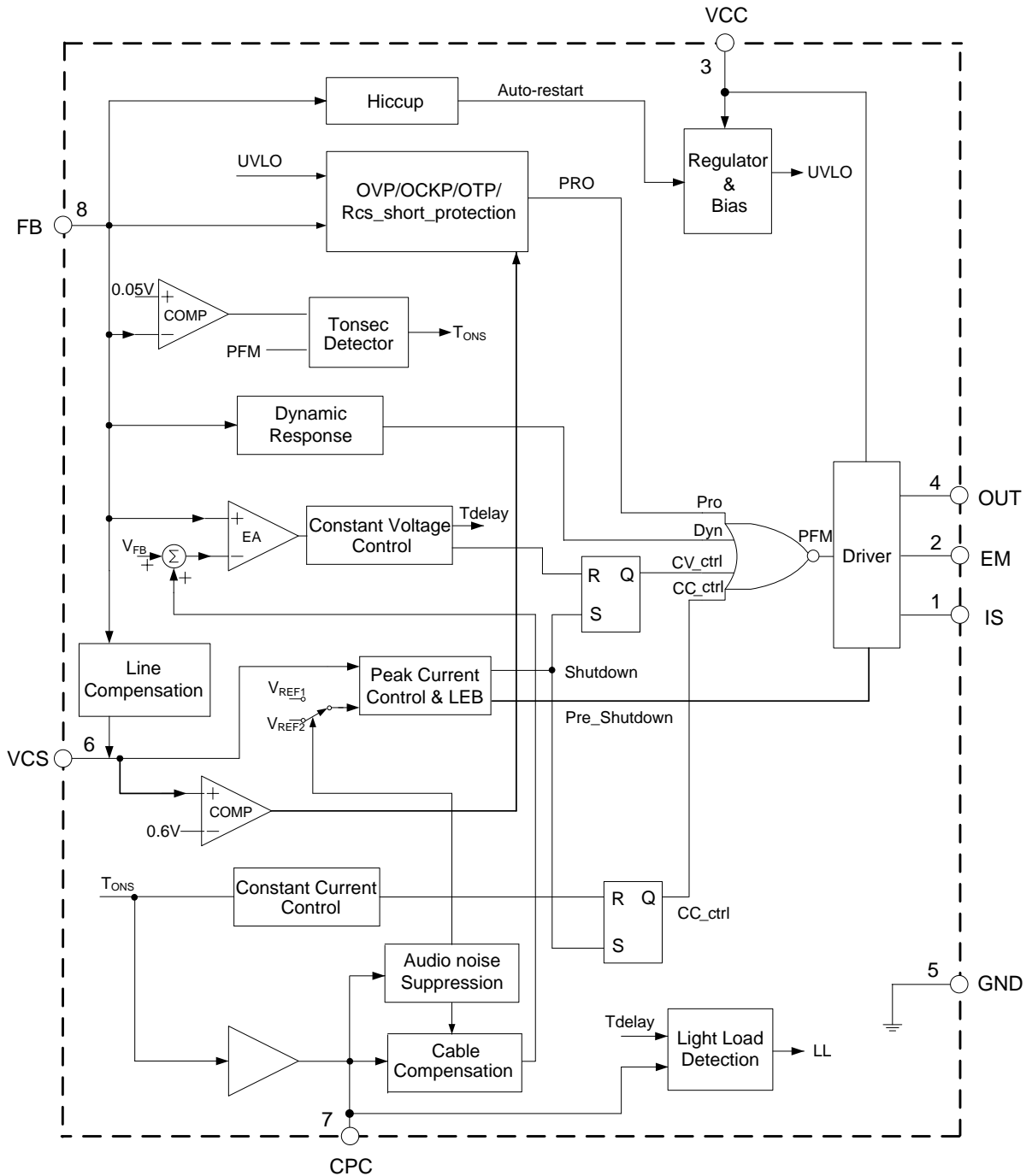
Typical Applications Circuit



Pin Descriptions

Pin Number	Pin Name	Function
1	IS	Primary current sensing
2	EM	Connected to the source of external power MOSFET
3	VCC	Power supply
4	OUT	Driving the gate of external power MOSFET
5	GND	Ground
6	VCS	Current sensing voltage
7	CPC	Connecting a capacitor for output cable compensation
8	FB	Voltage feedback

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating	Unit
V_{CC}	Voltage at VCC to GND	-0.3 to 25	V
–	Voltage at OUT, EM to GND	-0.3 to 23	V
–	Voltage at IS, VCS, CPC to GND	-0.3 to 7	V
–	FB Input	-40 to 10	V
–	Output Current at OUT	Internally limited	A
T_J	Operating Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
T_{LEAD}	Lead Temperature (Soldering, 10 Sec)	+300	°C
θ_{JA}	Thermal Resistance (Junction to Ambient)	190	°C/W

Note 4: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Electrical Characteristics (@ $T_A=+25^\circ\text{C}$, $V_{CC}=15\text{V}$, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
UVLO SECTION						
$V_{TH}(ST)$	Start-up Threshold	–	11	13	14	V
$V_{OPR}(Min)$	Minimal Operating Voltage	After turning on	2.5	3.0	3.6	
STANDBY CURRENT SECTION						
I_{ST}	Start-up Current	$V_{CC}=V_{TH}(ST)-1\text{V}$, Before turning on	0	0.2	0.6	μA
–	Standby Current	–	60	100	120	
$I_{CC}(OPR)$	Operating Current	Static current	160	250	300	
CURRENT SENSE SECTION						
V_{CS}	Current Sense Threshold (Note 5)	–	425	450	465	mV
t_{LEB}	Leading Edge Blanking	The minimum power switch turn on time	300	500	700	ns
FEEDBACK INPUT SECTION						
I_{FB}	Feedback Pin Input Leakage Current	$V_{FB}=4\text{V}$	4	6	8	μA
V_{FB}	Feedback Threshold Voltage	–	3.62	3.68	3.73	V

Electrical Characteristics (Cont.) (@T_A=+25°C, V_{CC}=15V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
LINE COMPENSATION SECTION						
g_m	Line Compensation Transconductance (Note 6)	–	0.55	0.7	0.85	μS
CABLE COMPENSATION SECTION						
$V_{FB_CABLE}/V_{FB} \%$	Cable Compensation Voltage	–	5	6	7	%
DRIVE OUTPUT SECTION						
V_{GATE}	Gate Voltage	V _{CC} =15V, C _L =1nF	5.5	6.5	7.5	V
I_{SOURCE}	Drive Source Current	–	30	34	40	mA
R_{SINK}	Sink Resistance	–	2	5	7	Ω
$t_{OFF(MAX)}$	Maximum Off Time	–	15	19	30	ms
DYNAMIC FUNCTION SECTION						
t_D	Delay Time for Dynamic Function	–	100	140	220	μs
$V_{TRIGGER}$	Trigger Voltage for Dynamic Function	–	60	100	120	mV
PROTECTION SECTION						
$t_{onp(MAX)}$	Maximum On Time of Primary Side	–	16	25	40	μs
$V_{CS(MAX)}$	Over Current Protection	–	0.49	0.55	0.62	V
$V_{FB(OVP)}$	Over Voltage Protection	–	6.5	7.5	8.5	V
$V_{FB(SCP)}$	Short Circuit Protection	–	2.18	2.3	2.42	V
–	Over Temperature Protection (Note 7)	Surface temperature	+125	+160	–	°C
–	Temperature Hysteresis (Note 7)	–	+40	–	–	°C

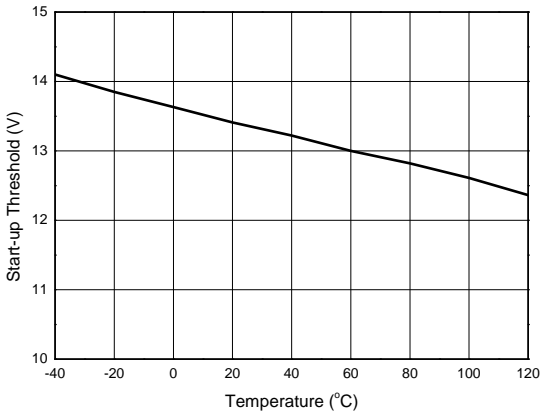
Notes: 5. V_{CS} is an equivalent parameter tested in closed loop to ensure the precise constant current.

6. Line compensation voltage on CS pin: $\Delta V_{CS} = V_{IN_DC} \cdot \frac{N_{AUX}}{N_{PRI}} \cdot \frac{R_{17}}{R_{16} + R_{17}} \cdot g_m \cdot R_5$

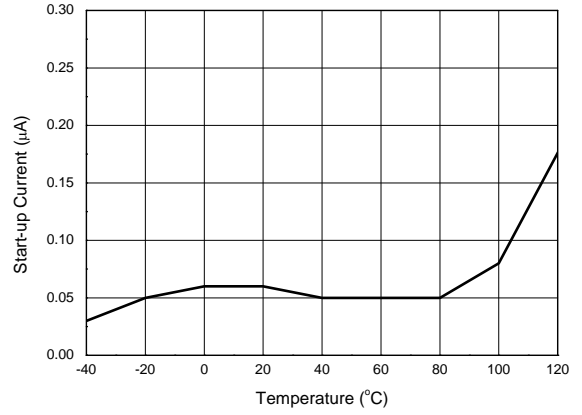
7. Guaranteed by design.

Performance Characteristics

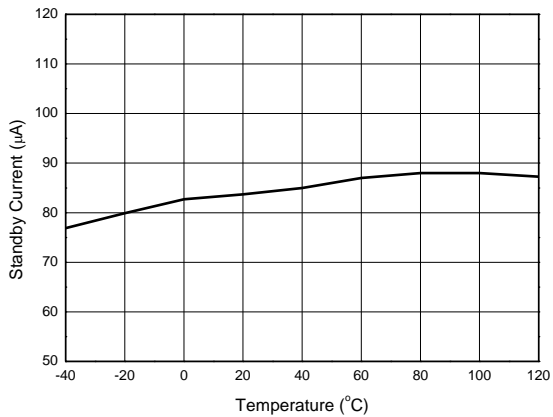
Start-up Threshold vs. Temperature



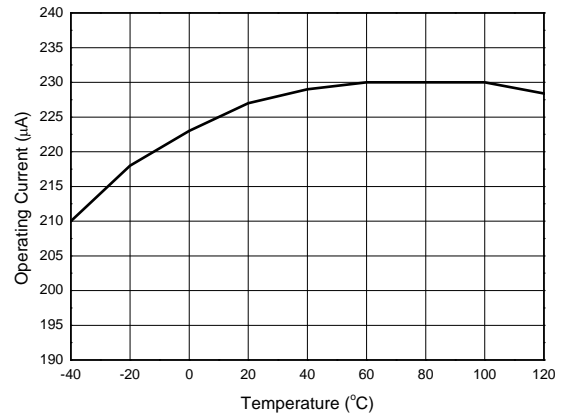
Start-up Current vs. Temperature



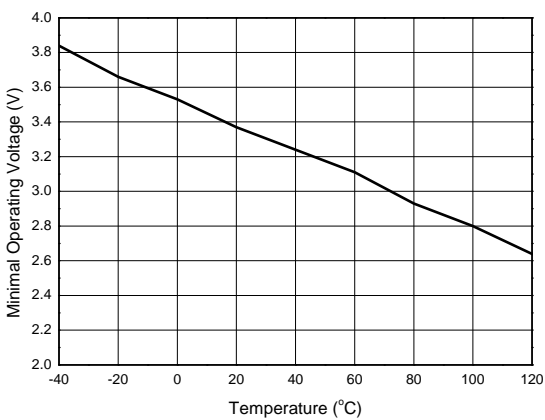
Standby Current vs. Temperature



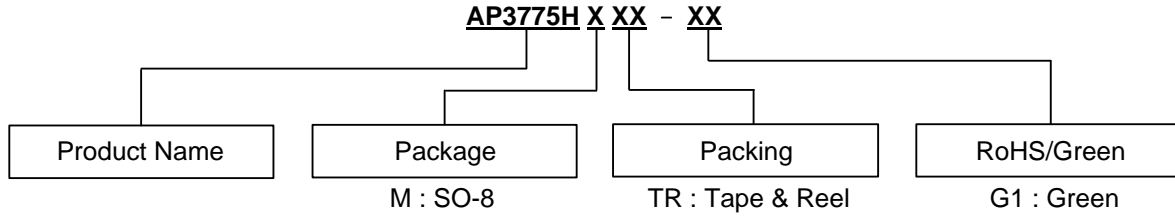
Operating Current vs. Temperature



Minimal Operating Voltage vs. Temperature



Ordering Information

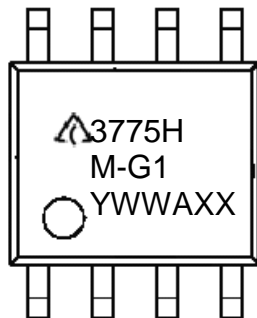


Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

Package	Temperature Range	Part Number	Marking ID	Packing
SO-8	-40 to +85°C	AP3775HMTR-G1	3775HM-G1	4000/Tape & Reel

Marking Information

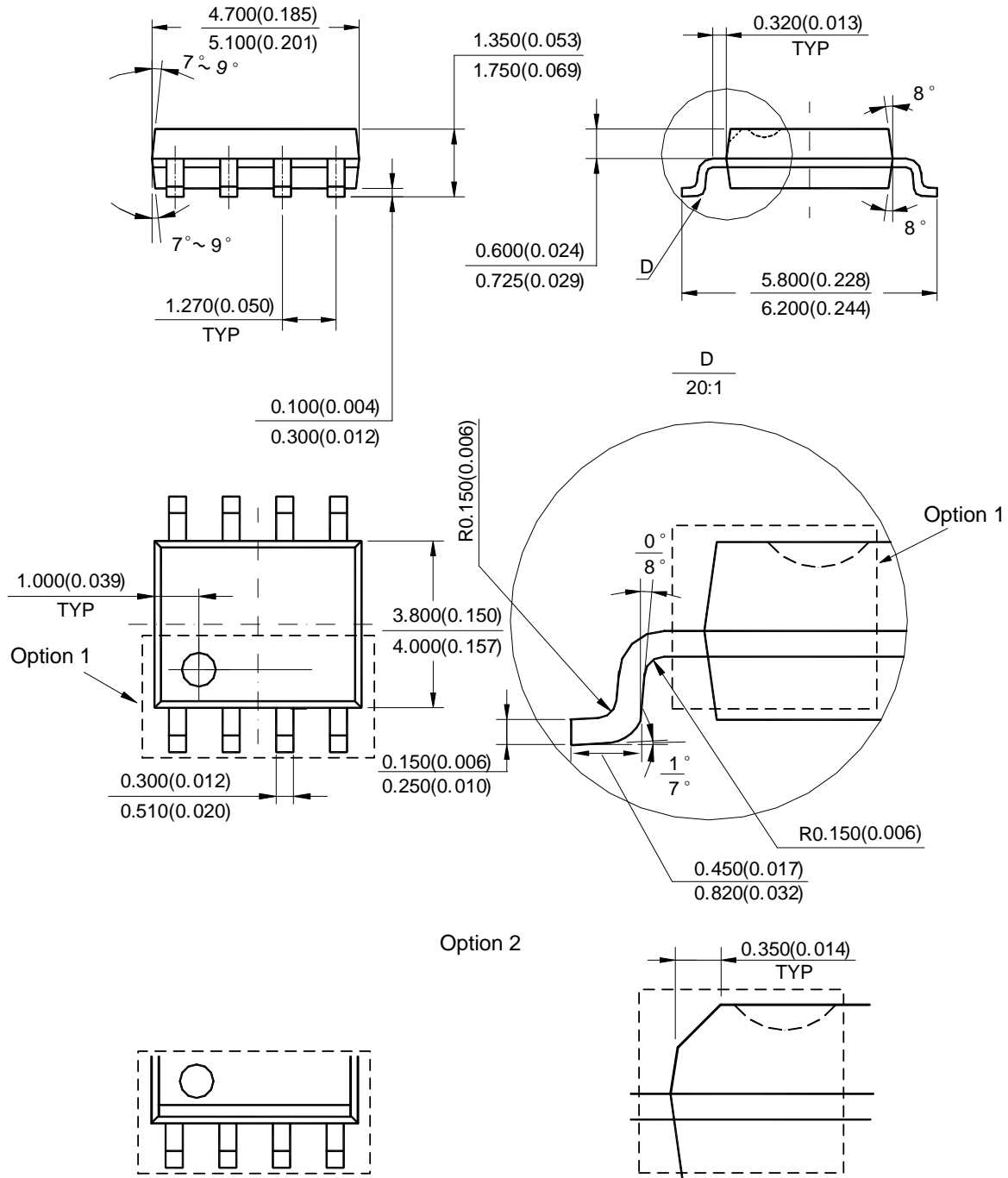
(Top View)



First and Second Lines: Logo and Marking ID
 Third Line: Date Code
 Y: Year
 WW: Work Week of Molding
 A: Assembly House Code
 XX: 7th and 8th Digits of Batch No.

Package Outline Dimensions (All dimensions in mm(inch).)

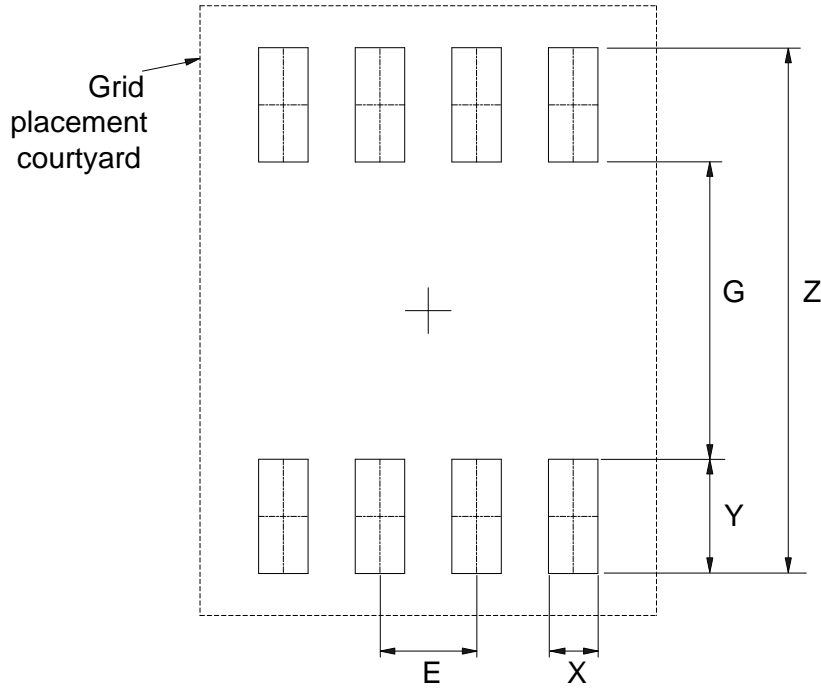
(1) Package Type: SO-8



Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout

(1) Package Type: SO-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

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