LTC2956
Wake-Up Timer with Pushbutton Control

DESCRIPTION

Demonstration circuits 2254A-A and 2254A-B feature the LTC2956-1 and LTC2956-2, respectively. The LTC®2956 is a micropower, wide input voltage range, configurable wake-up timer with pushbutton control. It periodically wakes up and turns on a connected system to perform tasks like monitoring temperature or capturing images. After completing the task, the LTC2956 turns the system off to conserve power. The wake-up timer period can be adjusted from 250ms to 39 days.

The DC2254A allows easy access to all the pins necessary to configure the device. Onboard jumpers, and an 8-pin DIP switch provide a range of value options, to set the wake-up timer, wake-up timer period and long power down time. Turrets are also present, allowing direct access to all the pins present on the LTC2956 to allow easy interfacing with a system with arbitrary requirements.

Design files for this circuit board are available at http://www.linear.com/demo/DC2254A

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BOARD PHOTO

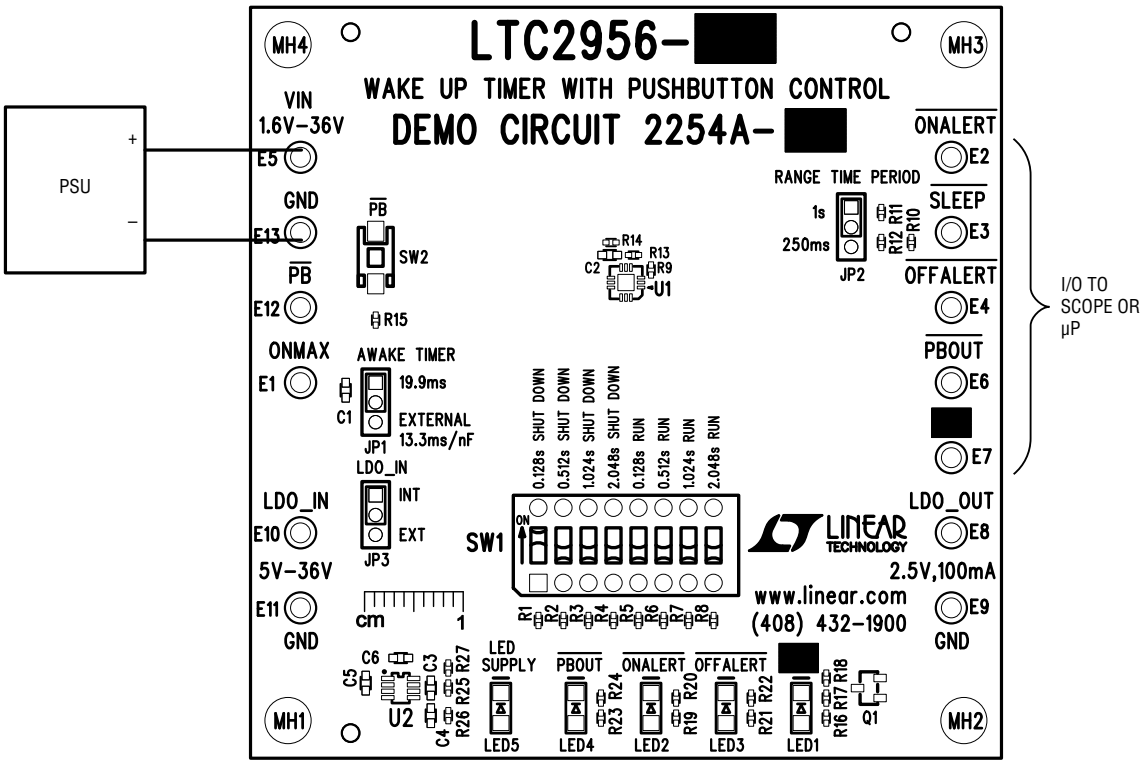


Figure 1. Test Equipment Setup

DC2254A TURRET AND JUMPER DEFINITIONS

JUMPER AND SWITCH SETTINGS

RANGE TIME PERIOD (JP2): Sets the time period between enable signal assertions. The two available options present on the board are 250ms and 1s. See Applications Information in the LTC2956 data sheet and replace R11 and/or R12 if another time is desired.

AWAKE TIMER (JP1): Sets the time the enable signal stays asserted. The onboard capacitor can be used for an awake time of 19.9ms or an external arbitrary capacitor can be used to set a user defined enable time. The maximum allowed awake time is set at 13.3ms/nF.

LDO_IN (JP3): Choose the input to the onboard LT3060 regulator. It can either be set to INT to have it connected to the VIN pin, or EXT in order to have it driven by the LDO_IN turret. See the Operating Principles section. Only for LED/Monitor circuitry.

SW1: This 8 pin DIP switch can be used to initialize the part in either RUN or SHUTDOWN mode and also allows configuration of the t_{LONG} time. See Applications Information in the LTC2956 data sheet for more information.

SW2: This pushbutton switch controls the input to the $\overline{PB}$ pin. This is an active low input with a 900kΩ pull up to an internal 3.3V regulated supply. When the pushbutton is pressed, EN/$\overline{EN}$ pin gets asserted after an initial debounce time of 32ms.

EXTERNAL CONNECTIONS

Signal connections are made via the row of turret posts along the edges of the board.

GND: (3 Turrets) These turrets are connected directly to the ground planes.

VIN: Connect a 1.6V to 36V power supply to this turret.

ONMAX: Connect a capacitor from this turret to GND if an arbitrary awake time is desired. Use the relationship $t_{AWAKETIME}$ = 13.3ms/nF. Set the AWAKE TIMER jumper to EXTERNAL if using this turret.

$\overline{PB}$: This turret is already driven by the pushbutton present on the demoboard, however if needed it can be driven by an external signal to simulate a pushbutton press.

LDO_IN: Can be used to provide the LT3060 with power when the LDO_IN jumper is set to EXT.

LDO_OUT: Output from the LT3060. The state of this turret can be monitored by the LED labelled “LED SUPPLY”.

DIGITAL CONNECTIONS

EN/$\overline{EN}$: Active high (LTC2956-1) or active low (LTC2956-2) signal. Should go active either with a debounced pushbutton press or after a valid time period set by the RANGE TIME PERIOD jumper.

$\overline{ONALERT}$: This turret pulls low whenever the part goes from SHUTDOWN mode to RUN mode. The signal stays low while the EN/$\overline{EN}$ pin is asserted and it can be used as an input to a system to request for initial boot up routine. This turret may be left open if unused.

$\overline{OFFALERT}$: This turret pulls low for 1 second whenever the part goes from RUN mode to SHUTDOWN mode. This pin can be connected to the interrupt input (with a pullup resistor to the system supply) of a system to alert the system before shutdown. This pin may be left open if unused.

$\overline{SLEEP}$: This turret is an input and is active during RUN mode. In the Awake state, a falling edge at the $\overline{SLEEP}$ input will de-assert EN/$\overline{EN}$ and put the system into the Sleep state. If the $\overline{SLEEP}$ input goes high during the Sleep state, the LTC2956 reenters the Awake state and re-asserts EN/$\overline{EN}$ to turn a system on. Holding this turret high for more than t_{LONG} (which is set by SW1) will force the LTC2956 into SHUTDOWN mode. See data sheet for more details.

$\overline{PBOUT}$: This turret follows the debounced $\overline{PB}$ input. This turret may be left open if unused.

OPERATING PRINCIPLES

Connect a 1.6V to 36V power supply to VIN. If VIN is less than 5.5V then set the LDO_IN jumper to EXTERNAL and connect a 5.5V to 35V supply to the LDO_IN turret. The LTC2956 will still operate with no power applied to LDO_IN, but monitor LEDs will not function.

RUN AND SHUTDOWN MODE

The LTC2956 has two modes of operation: RUN mode and SHUTDOWN mode.

In RUN mode, the LTC2956 cycles between the Awake state and the Sleep state with a period of t_{PERIOD} which is set by the RANGE TIME PERIOD jumper. During the Awake state, the EN/$\overline{EN}$ pin is asserted to turn the system on, and the t_{ONMAX} timer runs. The t_{ONMAX} timer can be configured with the AWAKE TIMER jumper. The LTC2956 exits the Awake state when a falling edge is detected on the $\overline{SLEEP}$ pin or if the t_{ONMAX} timer expires. In the Sleep state the EN/$\overline{EN}$ output stays de-asserted. The LTC2956 only returns to the Awake state when the t_{PERIOD} time is reached, pushbutton is pressed or if a logic high is detected on the $\overline{SLEEP}$ pin. The LTC2956 can be put into SHUTDOWN mode if the pushbutton is held low for longer than a user defined t_{LONG} period.

The SHUTDOWN mode is a very low power mode with the timer disabled, entered through a press of the pushbutton or a high pulse at the $\overline{SLEEP}$ input which lasts longer than t_{LONG}. A short press on the pushbutton brings the LTC2956 back into RUN mode.

On power up, the LTC2956 can be initialized to either of these two modes. SW1 provides 8 different options to initialize the part as shown in Table 1.

Table 1. SW1 Configuration Table

SW1 POSITION	MODE	TLONG
1	SHUTDOWN	0.128s
2	SHUTDOWN	0.512s
3	SHUTDOWN	1.024s
4	SHUTDOWN	2.048s
5	RUN	0.128s
6	RUN	0.512s
7	RUN	1.024s
8	RUN	2.048s

$\overline{ONALERT}$ AND $\overline{OFFALERT}$ SIGNALS

The $\overline{ONALERT}$ signal pulls low when the LTC2956 enters RUN mode from SHUTDOWN. This signal is useful to allow connected systems to run initialization tasks.

The $\overline{OFFALERT}$ signal pulls low when the LTC2956 enters SHUTDOWN mode from RUN mode. When the $\overline{PB}$ pin is held low for a time longer than t_{LONG} during RUN mode, the LTC2956 first pulls the $\overline{OFFALERT}$ pin low which lasts for t_{OFF} (1s typ). Once the t_{OFF} timer completes, the LTC2956 transitions to the SHUTDOWN mode.

OPERATING PRINCIPLES

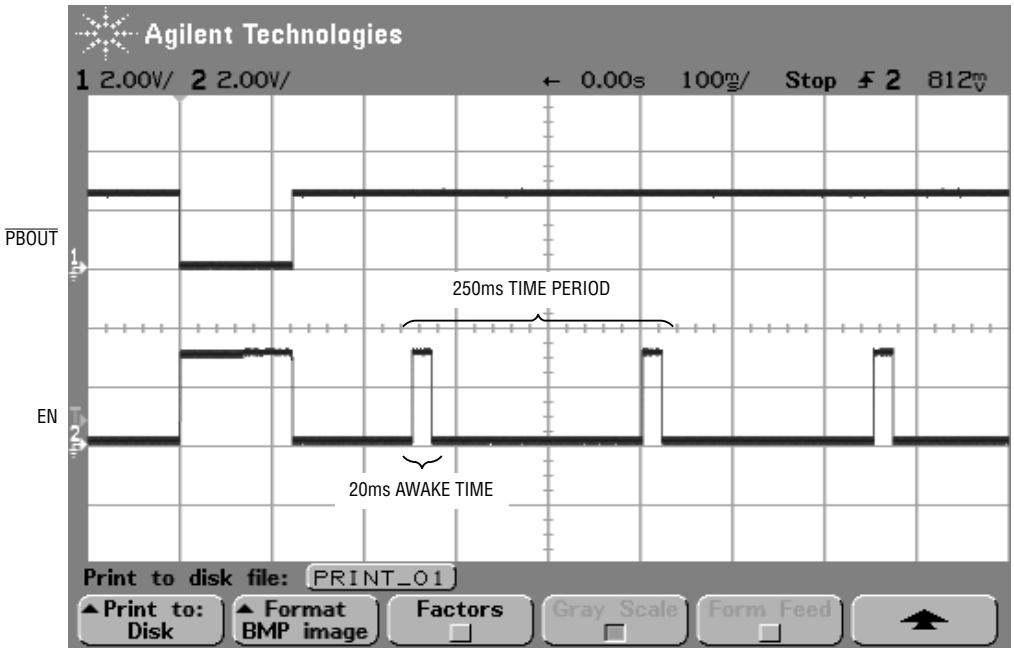


Figure 2. LTC2956-1, Awake Time Set to 20ms, Time Period Set to 250ms

OPERATING PRINCIPLES

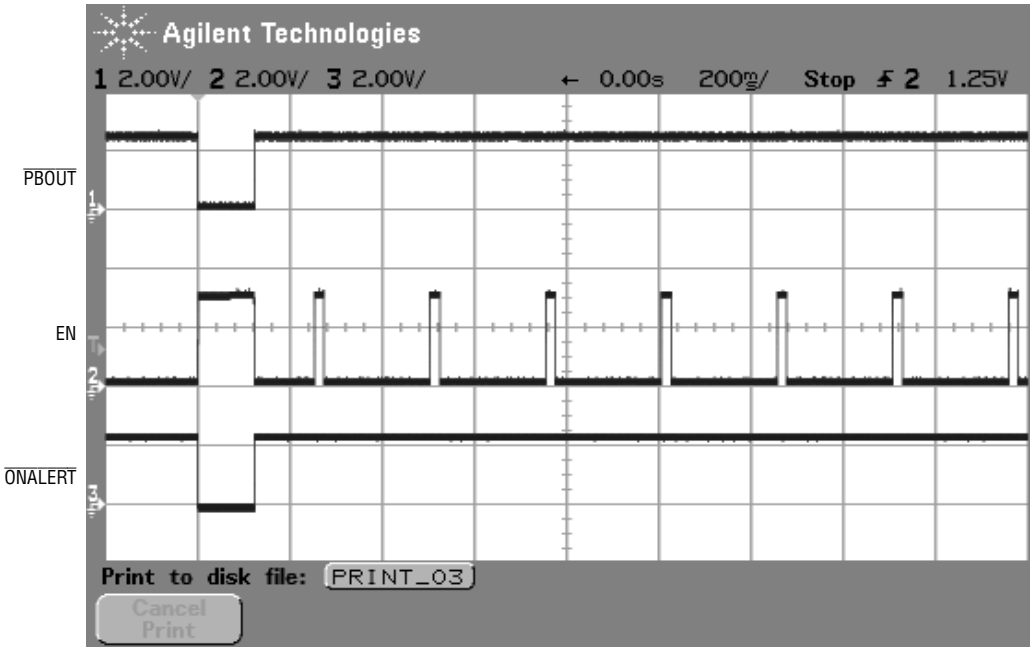


Figure 3. LTC2956-1, Awake Time Set to 20ms, Time Period Set to 250ms, Showing Proper Turn On Sequence with $\overline{\text{ONALERT}}$ Signal

OPERATING PRINCIPLES

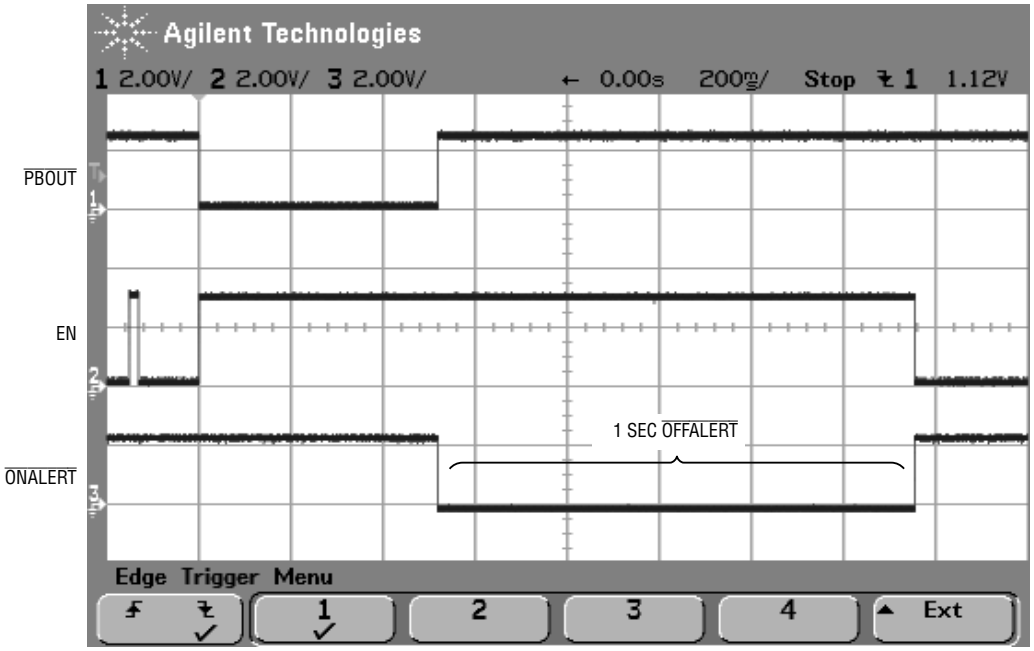


Figure 4. LTC2956-1, Awake Time Set to 20ms, Time Period Set to 250ms, Showing Proper Shutdown Sequence with $\overline{\text{OFFALERT}}$ Signal

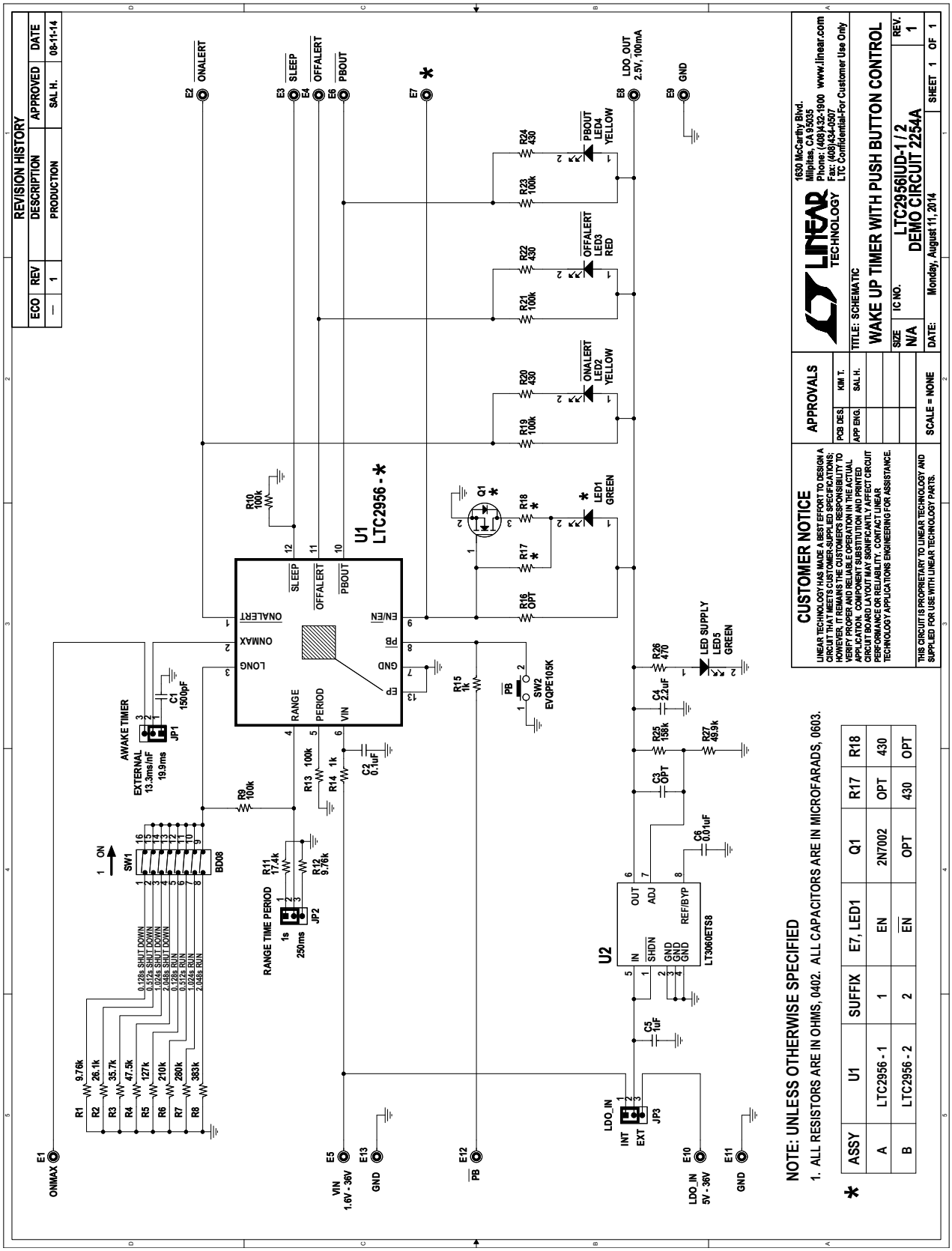
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., X7R, 1500pF, 25V, 10%, 0603	AVX, 06033C152KAT2A
2	1	C2	CAP., X7R, 0.1µF, 50V, 5%, 0603	AVX, 06035C104JAT2A
3	0	C3	CAP., 0603	OPT
4	1	C4	CAP., X7R, 2.2µF, 10V, 20%, 0603	MURATA, GRM188R71A225ME15D
5	1	C5	CAP., X5R, 1µF, 50V, 10%, 0603	NIC, NMC0603X5R105K50TRPF
6	1	C6	Cap., X7R, 0.01µF, 10V, 10%, 0603	AVX, 0603ZC103KAT2A
7	13	E1-E13	TP, TURRET, 0.064", PAD120-064	MILL-MAX, 2308-2-00-80-00-00-07-0
8	3	JP1, JP2, JP3	HD1X3-079	SAMTEC, TMM103-02-L-S
9	2	LED1, LED5	LED, GREEN	ROHM, SML-010FTT86L
10	2	LED2-LED4	LED, YELLOW	ROHM, SML-010YTT86M
11	1	LED3	LED, RED	ROHM, SML-010VTT86L
12	2	R1, R12	Res., Chip 9.76k, 1/16W, 1%, 0402	VISHAY, CRCW04029K76FKED
13	1	R2	Res., Chip 26.1k, 1/16W, 1%, 0402	VISHAY, CRCW040226K1FKED
14	1	R3	Res., Chip 35.7k, 1/16W, 1%, 0402	VISHAY, CRCW040235K7FKED
15	1	R4	Res., Chip 47.5k, 1/16W, 1%, 0402	VISHAY, CRCW040247K5FKED
16	1	R5	Res., Chip 127k, 1/16W, 1%, 0402	VISHAY, CRCW0402127KFKED
17	1	R6	Res., Chip 210k, 1/16W, 1%, 0402	VISHAY, CRCW0402210KFKED
18	1	R7	Res., Chip 280k, 1/16W, 1%, 0402	VISHAY, CRCW0402280KFKED
19	1	R8	Res., Chip 383k, 1/16W, 1%, 0402	VISHAY, CRCW0402383KFKED
20	6	R9, R10, R13, R19, R21, R23	Res., Chip 100k, 1/16W, 1%, 0402	VISHAY, CRCW0402100KFKED
21	1	R11	Res., Chip 17.4k, 1/16W, 1%, 0402	VISHAY, CRCW040217K4FKED
22	2	R14, R15	Res., Chip 1k, 1/16W, 1%, 0402	VISHAY, CRCW04021K00FKED
23	0	R16	Res, 0402	OPT
24	3	R20, R22, R24	Res., Chip 430, 1/16W, 5%, 0402	VISHAY, CRCW0402430RJNED
25	1	R25	Res., Chip 158k, 1/16W, 1%, 0402	VISHAY, CRCW0402158KFKED
26	1	R26	Res., Chip 470, 1/16W, 5%, 0402	VISHAY, CRCW0402470RJNED
27	1	R27	Res., Chip 49.9k, 1/16W, 1%, 0402	VISHAY, CRCW040249K9FKED
28	1	SW1	SWITCH, 8 Position DIP	C&K Components, BD08
29	1	SW2	SWITCH, Pushbutton	PANASONIC, EVQPE105K
30	1	U2	I.C., LT3060ETS8, TS8	LINEAR TECH., LT3060ETS8
31	4	MH1-MH4	STAND-OFF, NYLON 0.25" TALL	KEYSTONE, 8831(SNAP ON)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
DC2254A-A Required Circuit Components				
1	1		DC2254A1-GENERAL BOM	
2	1	Q1	MOSFET, N-CH, SOT23	FAIRCHILD SEMI., 2N7002
3	0	R17	RES., 0402	OPT
4	1	R18	RES., CHIP, 430, 1/16W 5%, 0402	VISHAY, CRCW0402430RJNED
4	1	U1	I.C., QFN12UD-3X3	LINEAR TECH., LTC2956IUD-1
DC2254A-B Required Circuit Components				
1	1		DC2254A1-GENERAL BOM	
2	0	Q1	MOSFET, N-CH, SOT23	OPT
3	1	R17	RES., CHIP, 430, 1/16W, 5%, 0402	VISHAY, CRCW0402430RJNED
4	0	R18	RES., 0402	OPT
4	1	U1	I.C., QFN12UD-3X3	LINEAR TECH., LTC2956IUD-2

SCHEMATIC DIAGRAM



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