



# LC75821E, 75821W

## LCD Display Drivers

### Overview

The LC75821E and LC75821W are general-purpose LCD display drivers that can be used for frequency display in microprocessor-controlled radio receivers and in other display applications.

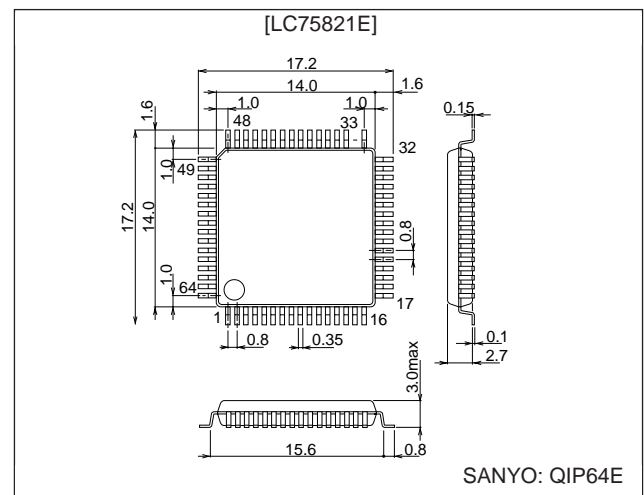
### Features

- 53 segment outputs (the maximum for static drive)
- Two drive types: static (1/1) duty (53 segments) and 1/2 duty (104 segments)
- Data input: 3 serial input pins
- INH pin for turning off all display output
- The difference from the LC7582: The LC75821E, LC75821W are A/D converter, DSP function-removed versions of the LC7582 of which the functions other than the two can be used with pin compatibility with the LC7582 kept.

### Package Dimensions

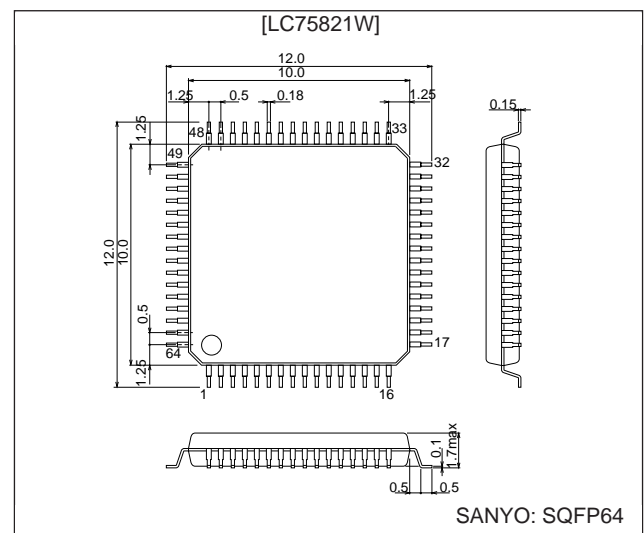
unit: mm

#### 3159-QFP64E



unit: mm

#### 3190-SQFP64



## Specifications

### Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$ , $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{DD\text{ max}}$	$V_{DD}$	-0.3 to +7.0	V
	$V_{LCD}$	$V_{LCD}$	-0.3 to $V_{DD} + 0.3$	V
Input voltage	$V_{IN1}$	CE, CLK, DATA, $\overline{\text{INH}}$	-0.3 to +7.0	V
	$V_{IN2}$	OSC: output off	-0.3 to $V_{DD} + 0.3$	V
Output voltage	$V_{OUT}$	OSC: output off	-0.3 to $V_{DD} + 0.3$	V
Output current	$I_{OUT1}$	S1 to S53	100	$\mu\text{A}$
	$I_{OUT2}$	COM1, COM2	1.0	mA
Allowable power dissipation	$P_{d\text{ max}}$	$T_a = 85^\circ\text{C}$	100	mW
Operating temperature	$T_{opr}$		-40 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +125	$^\circ\text{C}$

### Allowable Operating Ranges at $T_a = -40$ to $+85^\circ\text{C}$ , $V_{SS} = 0\text{ V}$

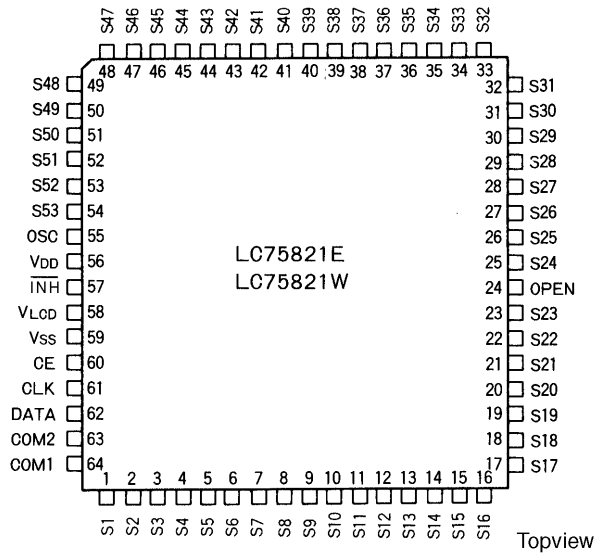
Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage	$V_{DD}$	$V_{DD}$	3.0		6.5	V
	$V_{LCD}$	$V_{LCD}$	3.0		$V_{DD}$	V
Input high-level voltage	$V_{IH1}$	$\overline{\text{INH}}$	0.7 $V_{DD}$		6.5	V
Input high-level voltage	$V_{IH2}$	CE, CLK, DATA	0.8 $V_{DD}$		6.5	V
Input low-level voltage	$V_{IL1}$	$\overline{\text{INH}}$	0		0.3 $V_{DD}$	V
Input low-level voltage	$V_{IL2}$	CE, CLK, DATA	0		0.2 $V_{DD}$	V
Recommended external resistance	$R_{OSC}$	OSC		51		$\text{k}\Omega$
Recommended external capacitance	$C_{OSC}$	OSC		680		pF
Guaranteed oscillation range	$f_{OSC}$	OSC	25	50	100	kHz
Clock low-level pulse width	$t_{\phi L}$	CLK	0.25			$\mu\text{s}$
Clock high-level pulse width	$t_{\phi H}$	CLK	0.25			$\mu\text{s}$
Data setup time	$t_{sup}$	CLK, DATA	0.25			$\mu\text{s}$
Data hold time	$t_{dh}$	CLK, DATA	0.25			$\mu\text{s}$
Serial data pulse width	$t_1$	CE, DATA	1			$\mu\text{s}$
	$t_2$	CE, CLK	1.25			$\mu\text{s}$
	$t_3$				1	$\mu\text{s}$
	$t_4$		4			$\mu\text{s}$

### Electrical Characteristics for the Allowable Operating Ranges

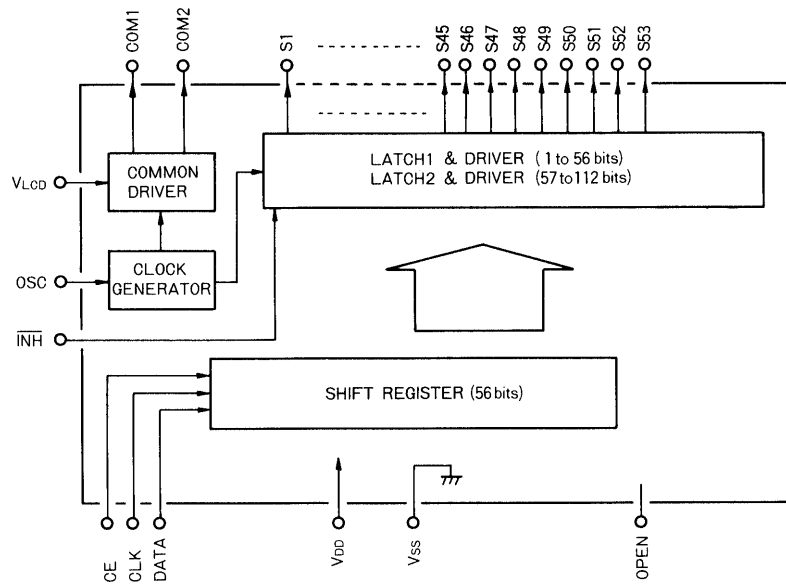
Parameter	Symbol	Conditions	min	typ	max	Unit
Input high-level current	$I_{IH}$	CE, CLK, DATA, $\overline{\text{INH}}$ : $V_I = 6.5\text{ V}$			5	$\mu\text{A}$
Input low-level current	$I_{IL}$	CE, CLK, DATA, $\overline{\text{INH}}$ : $V_I = 0\text{ V}$	-5			$\mu\text{A}$
Output high-level voltage	$V_{OH1}$	S1 to S53: $I_O = -10\ \mu\text{A}$	$V_{DD} - 1.0$			V
Output high-level voltage	$V_{OH2}$	COM1, COM2: $I_O = -100\ \mu\text{A}$	$V_{LCD} - 0.6$			V
Output low-level voltage	$V_{OL1}$	S1 to S53: $I_O = 10\ \mu\text{A}$			1.0	V
Output low-level voltage	$V_{OL2}$	COM1, COM2: $I_O = 100\ \mu\text{A}$			0.6	V
Mid-level voltage	$V_{MID1}$	COM1, COM2: $V_{LCD} = 6.5\text{ V}$ , $I_O = \pm 100\ \mu\text{A}$	2.65	3.25	3.85	V
	$V_{MID2}$	COM1, COM2: $V_{LCD} = 3.0\text{ V}$ , $I_O = \pm 100\ \mu\text{A}$	0.9	1.5	2.1	V
Oscillator frequency	$f_{OSC}$	OSC: $R = 51\ \text{k}\Omega$ , $C = 680\ \text{pF}$	40	50	60	kHz
Hysteresis voltage	$V_H$	CE, CLK, DATA: $V_{DD} = 5\text{ V}$	0.3			V
Current drain	$I_{DD}$				0.6	mA
	$I_{LCD}$	$V_{LCD}$			2	mA

# LC75821E, 75821W

## Pin Assignment



## Block Diagram

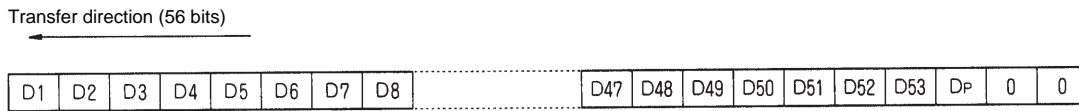


## Pin Functions

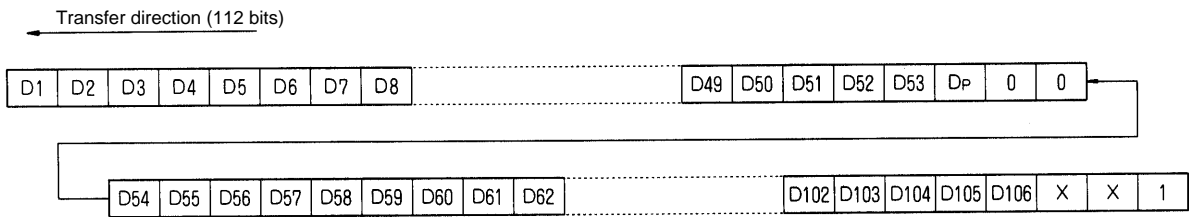
Pin	Function
S1 to S53	Segment output pins
COM1, COM2	Common output pins (Only COM1 is used in static (1/1) drive. COM2 must be left open in that mode.)
V <sub>LCD</sub>	LCD bias voltage setting
OSC	Oscillator connection
CE, CLK, DATA	Serial data transfer inputs
V <sub>SS</sub> , V <sub>DD</sub>	Power supply
INH	Display off control input INH = low (V <sub>SS</sub> ) .....Display off (S1 to S53, COM1, COM2 = low) INH = high (V <sub>DD</sub> ).....Display on Note that serial data transfers can be performed when display output is forced off.
OPEN	Make no connections to this pin.

**Data Transfer Format**

1. Static (1/1) duty



2. 1/2 duty (Only 56 bits need to be transferred if there are no more than 52 display segments. The transfer format is identical to the static duty case. It is not possible to change the D54 to D106 data without specifying the D1 to D53 data.)

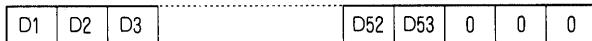


The values of bits D53 and D106 are ignored.(don't care)

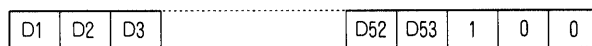
- D1 to D53: Display data (1/1 duty) Lighted at 1
- D1 to D106: Display data (1/2 duty) Unlighted at 0
- DP: Drive type selection bit
  - 1/2 duty at 1
  - 1/1 duty at 0
- x: don't care

**Data Transfer Examples**

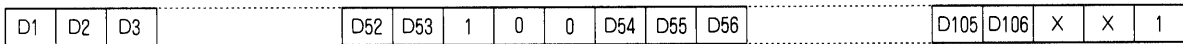
1. Static duty



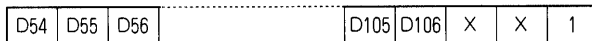
2. 1/2 duty with 52 or fewer segments



3. 1/2 duty with more than 52 segments

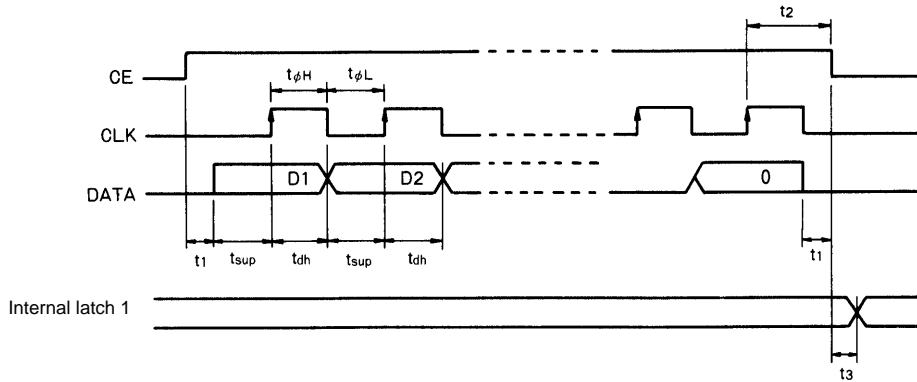


Note: The following transfer format is not allowed in 1/2 duty with 52 or fewer segments.

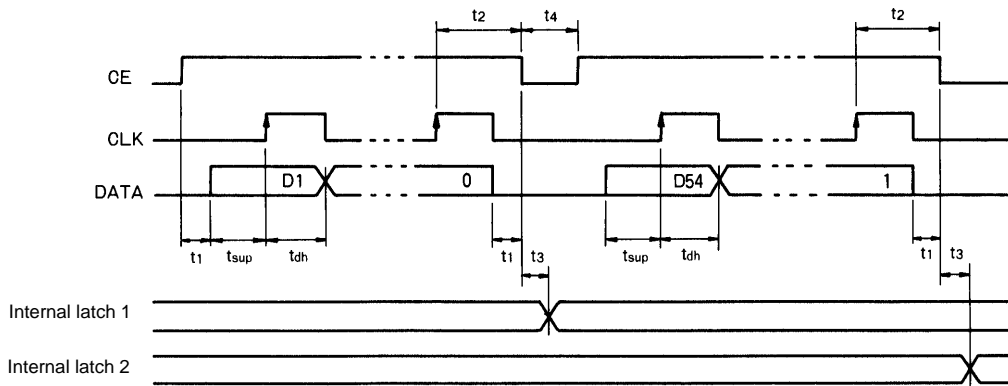


**Serial Data**

1. Static duty (56 bits)

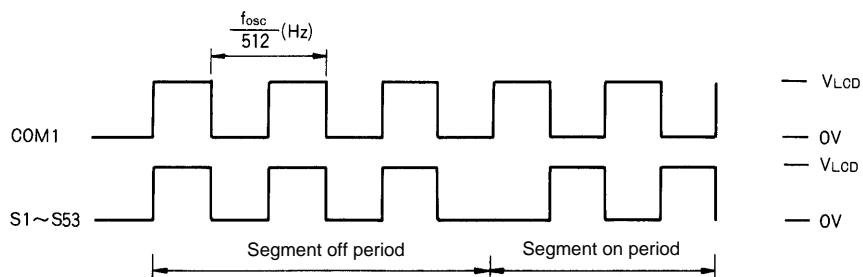


2. 1/2 duty (112 bits)

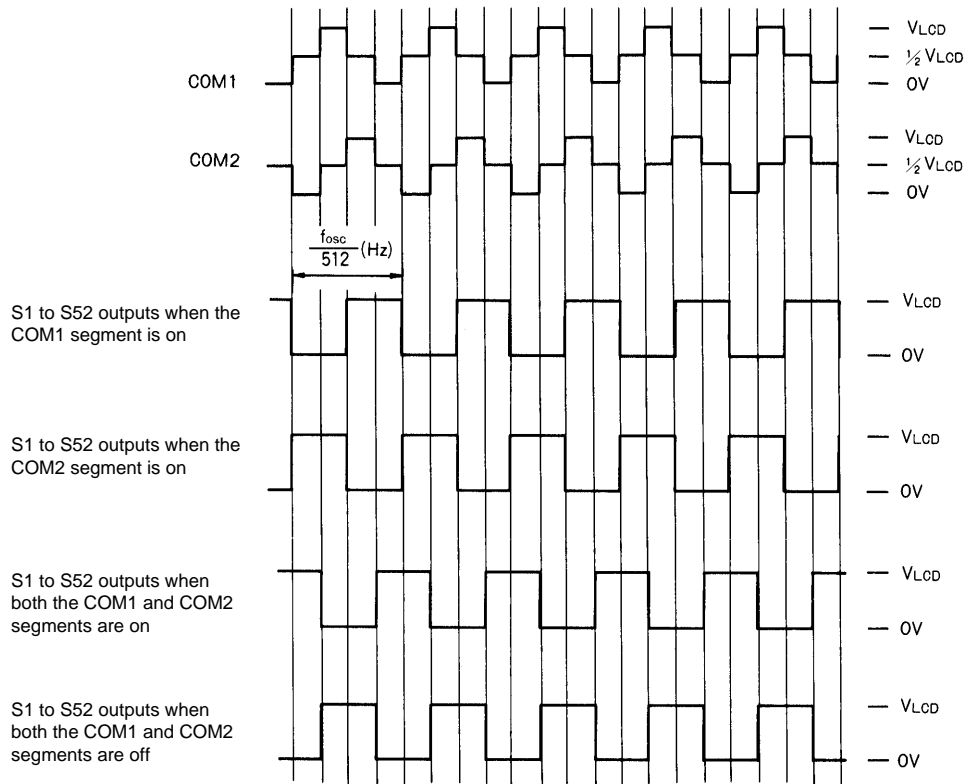


**Output Waveforms**

1. Static duty



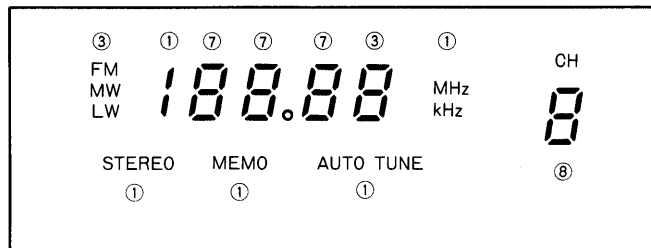
2. 1/2 duty



Display Examples

1. Static drive (1/1 duty)

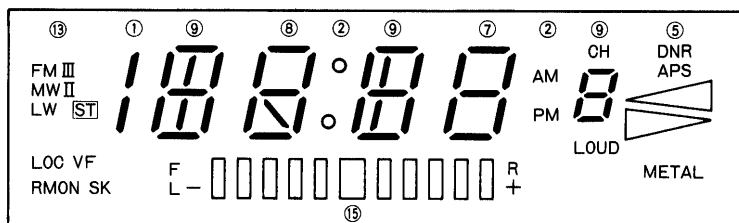
Example with 40 segments (Up to 53 segments can be driven.)



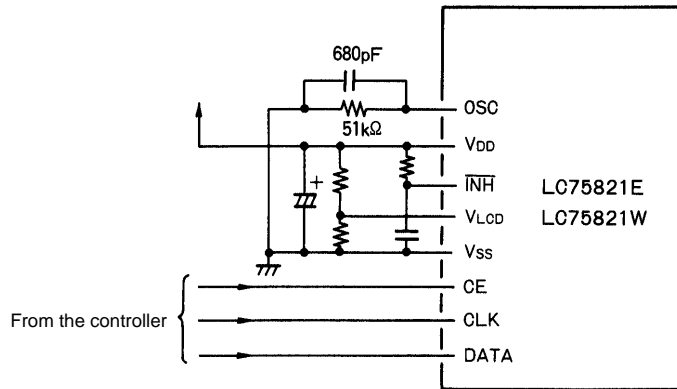
Note: Numbers in circles indicate the number of segments used.

2. 1/2 duty drive

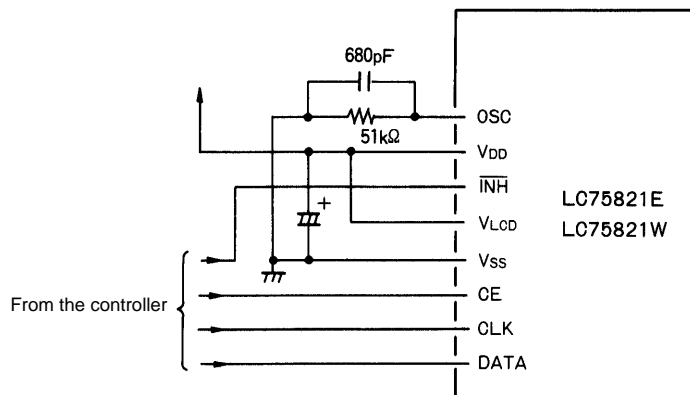
Example with 80 segments (Up to 104 segments can be driven.)



Sample Application Circuit 1



Sample Application Circuit 2



Note: The internal display data is undefined when power (V<sub>DD</sub>) is first applied. Since a meaningless pattern will be displayed if the display is turned on in that state, the display should be turned off by setting INH low and turned on only after display data has been sent from the controller.

LC75821E, 75821W

Transfer (external input) Data/Output Pin Correspondence

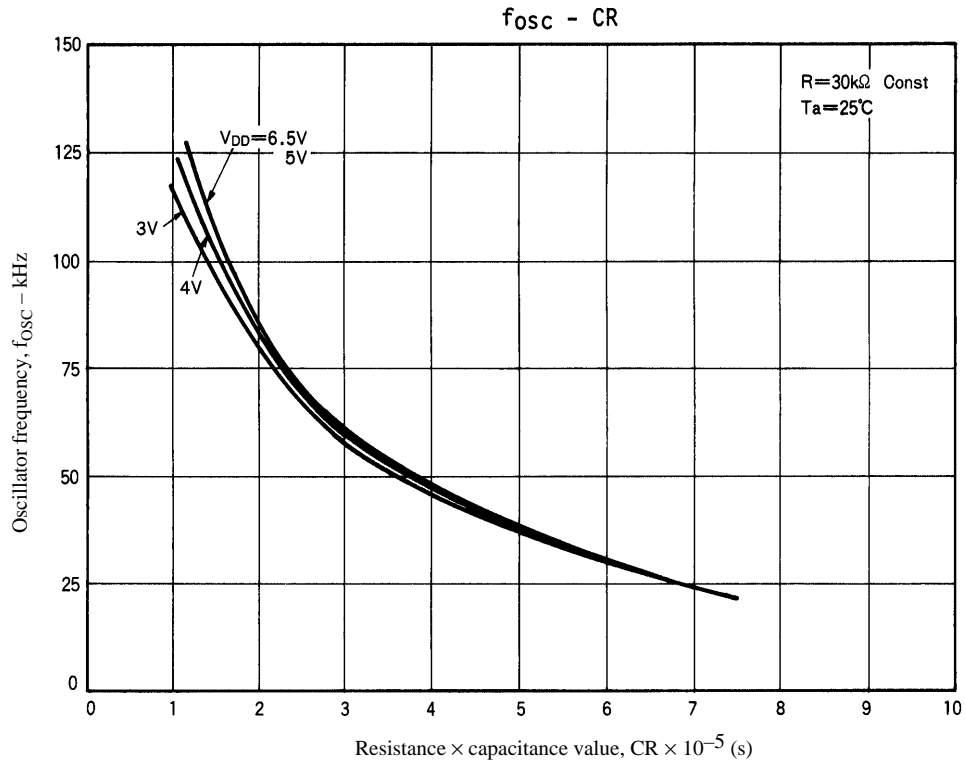
Output pin \ DP	0	1	COM1	COM2
	1/1 duty	1/2 duty		
S1	D1	D1	○	
		D2		○
S2	D2	D3	○	
		D4		○
S3	D3	D5	○	
		D6		○
⋮	⋮	⋮	⋮	⋮
S26	D26	D51	○	
		D52		○
S27	D27	D54	○	
		D55		○
S28	D28	D56	○	
		D57		○
⋮	⋮	⋮	⋮	⋮
S43	D43	D86	○	
		D87		○
S44	D44	D88	○	
		D89		○
S45	D45	D90	○	
		D91		○
S46	D46	D92	○	
		D93		○
S47	D47	D94	○	
		D95		○
S48	D48	D96	○	
		D97		○
S49	D49	D98	○	
		D99		○
S50	D50	D100	○	
		D101		○
S51	D51	D102	○	
		D103		○
S52	D52	D104	○	
		D105		○
S53	D53	Always on	○	
		Always on		○

Note: Only COM1 is used in static (1/1 duty) drive.

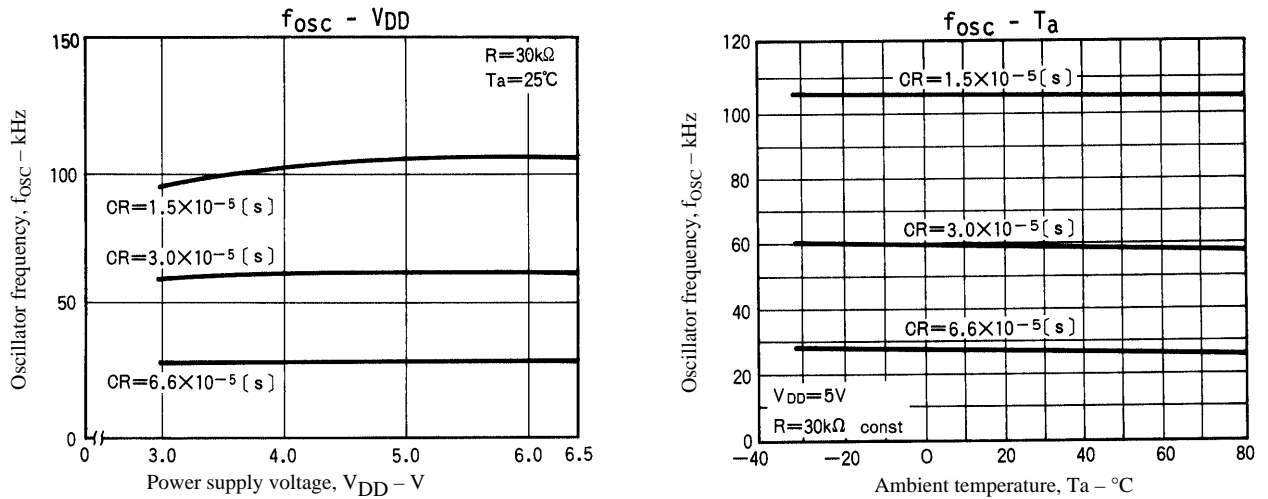


**Oscillator Frequency**

Refer to the figure below when determining the oscillator frequency.



**Figure 1 LC75821E, 75821W Oscillator Frequency vs. CR Constant**



**Figure 2 LC75821E, 75821W Oscillator Frequency vs. V<sub>DD</sub>**

Recommended range for external resistance: 10 to 100 kΩ (Carbon resistance)

Recommended range for external capacitance: 330 to 3300 pF

330 to 820 pF: (Ceramic capacitance with a zero temperature coefficient)

1000 to 3300 pF: (Mylar capacitance with a positive temperature coefficient)

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