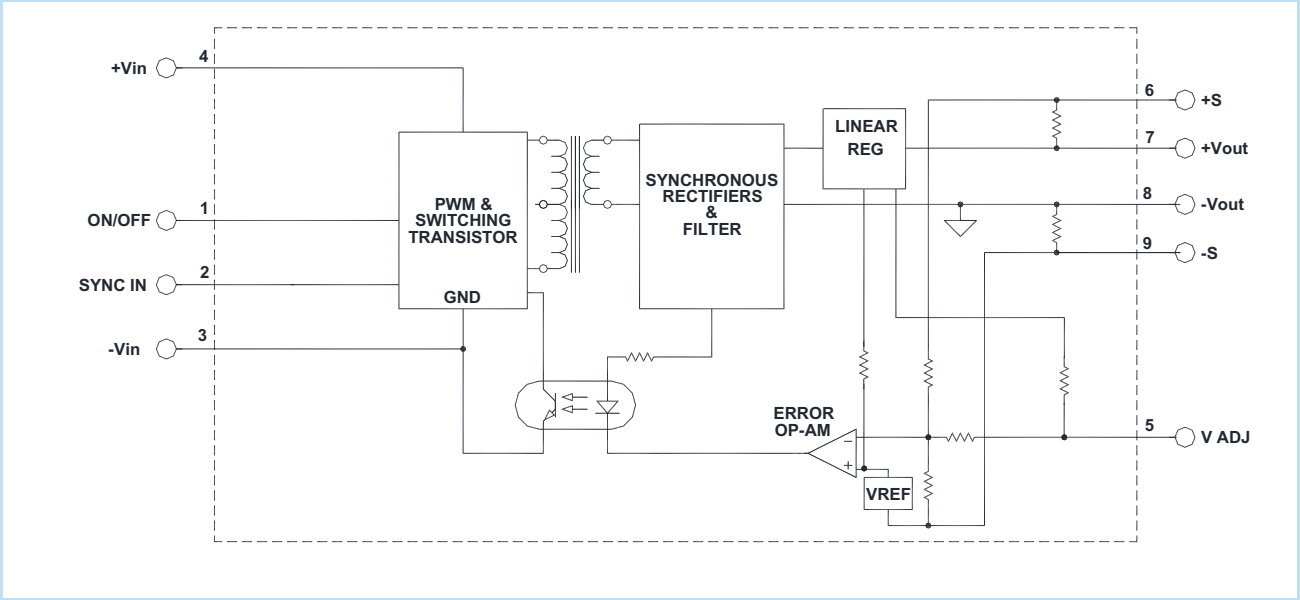
Q25W
25-30W DC/DC Converter
2”×1”×0.45”

Key Features

- Efficiency up to 87%
- Low output noise
- Six-sided shielding
- Output synchronous rectification
- Input-to-output isolation
- Soft start
- External synchronization
- Short circuit protection
- Thermal protection
- Industry standard pinout

Functional Description

The Q25 series is a 25-30W low noise isolated converter, consisting of 14 standard single & dual output models from 3.3VDC to 15 VDC and 4:1 input voltage range from 9V to 72V. Output synchronous rectification followed by a very low dropout linear regulator made possible to achieve up to 87% efficiency and less than 5mV output noise with external capacitors. Standard features include input undervoltage protection , external synchronization and thermal protection. The converter is packaged in a 1 x 2 x .45” metal case with six-sided shielding.



Typical Block Diagram

Unless otherwise specified, all parameters are given under typical ambient temperature of +25°C with an airflow rate = 400LFM. With the given power derating, the operating range is -40°C to +125°C. Specifications subject to change without notice.

Electrical Specifications

INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range	See model selection guide				Vdc
Input Startup Voltage 24 V_{IN}		8		9	Vdc
Input Startup Voltage 48 V_{IN}		14		17	Vdc
Overvoltage Shutdown 24 V_{IN}		37			Vdc
Overvoltage Shutdown 48 V_{IN}		73			Vdc
Input Filter	LC				
No Load Input Current	See model selection guide				mA
Full Load Input Current	See model selection guide				A
Input Surge Current (20μS Spike)				10	A
Short Circuit Current Limit	120% Of I_{IN} @ Full Load				
Off State Current			150		μA
Remote ON/OFF Control					
Supply ON	Pin 3 Open (Open circuit voltage: 10V Max.)				
Supply OFF		0		0.6	Vdc
Logic Input Reference					
Logic Compatability	TTL Open Collector or CMOS Open Drain				

OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Voltage	See model selection guide				Vdc
Output Voltage Accuracy			1		%
Output Current	See model selection guide				A
Output Voltage Adjustment	See Figure 15		±5	±10	%
Ripple & Noise	For further reduction see Figure 1 & Figure 4		40		mV
Line Regulation	Minimum V_{IN} to maximum V_{IN}		±.1		%
Load Regulation	NL to FL		±.1		%
Temperature Coefficient @ FL			.1	.2	%/°C
Transient Response Time	50% FL to FL to 50% FL, See Figure 11 & 13	100			μS
Short Circuit Protection	By input current limiting				
Turn On Delay with Soft Start	See Figure 12 & 14				
Output Overvoltage Protection	None				

GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency (at full power)	See model selection guide				%
Isolation Voltage (1 min.), Input to Output	All models		1500		Vdc
Isolation Resistance			10^9		Ω
Isolation Capacitance			300		pF
Switching Frequency (FC)			200		kHz
External Sync Frequency (Fe)	See figure 9		210		kHz

ENVIRONMENTAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Operating Temperature Range (Ambient)	Industrial, See Note 2	-40		+71	°C
Storage Temperature Range		-55		+125	°C
Maximum Operating Case Temperature[1]				110	°C
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		1.1×10^6		hours
Shielding Connection	- VIN for 24 VIN				
Shielding Connection	+ VIN for 48 VIN				

Model Selection Guide

MODEL NUMBER	INPUT				OUTPUT		
	Voltage (Vdc)		**Current** (mA)		**Voltage** (Vdc)	**Current** (mA)	**Efficiency Full Load** (%)
	Nominal	**Range**	**No Load**	**Full Load**			
Q25S3.3/24	24	9-36	52	2649	3.3	7580	79
Q25SS5/24	24	9-36	73	1240	5	5000	84
Q25S12/24	24	9-36	92	1250	12	2080	84
Q25S15/24	24	9-36	117	1251	15	1660	84
Q25S3.3/48	48	18-72	33	2375	3.3	7580	83
Q25S5/48	48	18-72	32	607	5	5000	85
Q25S12/48	48	18-72	44	605	12	2000	86
Q25S15/48	48	18-72	52	600	15	1660	87
Q25D5/24	24	9-36	25	1350	5	2500	77
Q25D12/24	24	9-36	47	1276	12	1040	82
Q25D15/24	24	9-36	50	1226	15	830	85
Q25D5/48	48	18-72	16	660	5	2500	78
Q25D12/48	48	18-72	97	628	12	1040	84
Q25D15/48	48	18-72	41	620	15	830	84

[1] When converter enters thermal protection on mode, its duty cycle is reduced momentarily and will resume after its internal temperature (pwm) drops down a few degrees (ºC).The converter's output behaves similar to hiccup short circuit mode.
[2] Contact factory for -55° to +85°C operating temperature range.
[3] The maximum input current at any given input range measured at minimum input voltage is given as $1.6*I_{NOMINAL}$. Nominal input current is the typical value measured at the input of the converter under full-load room temperature and nominal input voltage (24 and $48V_{IN}$).
[4] Adequate insulation is to be provided to the converters at the end usage as per applicable requirements.
[5] Temperature rise on the case of the converters is to be considered during the end usage as per applicable requirements.

ORDERING GUIDE

Q25 _ _ / _ _

- Power
- Number of Outputs (S = Single, D = Dual)
- Output Voltage
- Insert X for -55°C to +85°C *(Optional)*
- Input Voltage

Contact factory for custom input and output voltage combinations

PHYSICAL CHARACTERISTICS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Dimensions (L×W×H)	2.00×1.00×0.450 in. (50.80×25.40×11.43mm)				
Weight	1.3 oz. (37g)				

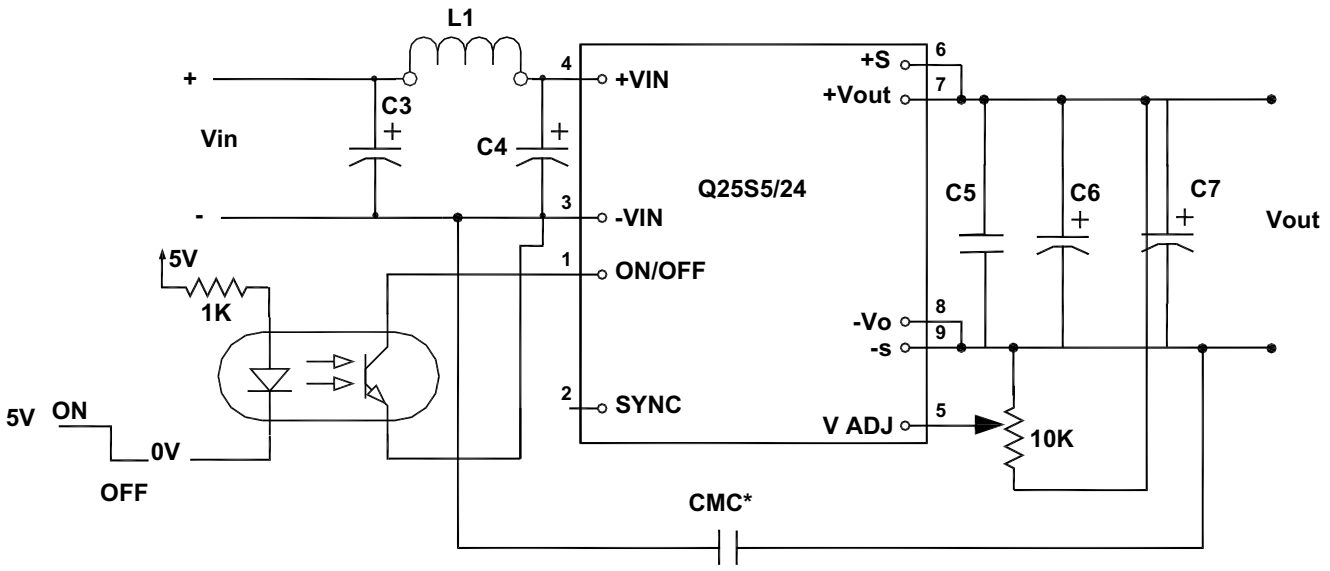


FIGURE 1. Typical connection diagram for Q25S5/24.

Part list for Figure 1:
L1= 2.2µH
C3= 50µF@100V Electrolytic
C4=50µF@100V Electrolytic
C5= 10µF Ceramic Capacitors
C6,C7=22µF@35V Low Esr Tantalum

CMC*=Common Mode Capacitor
CMC= .01µF@Vcmc
Vcmc >= than required isolation, voltage can be up to 1500V dc max.

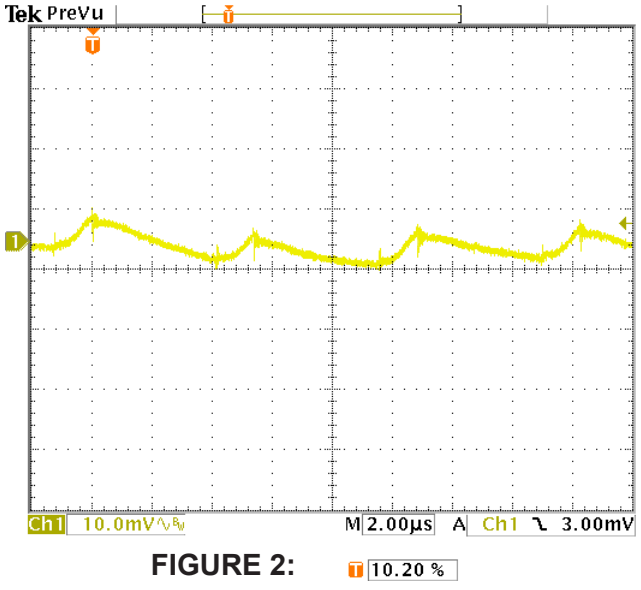


FIGURE 2:

FIGURE 2: Output ripple of Q25S5/24 as shown in figure1.

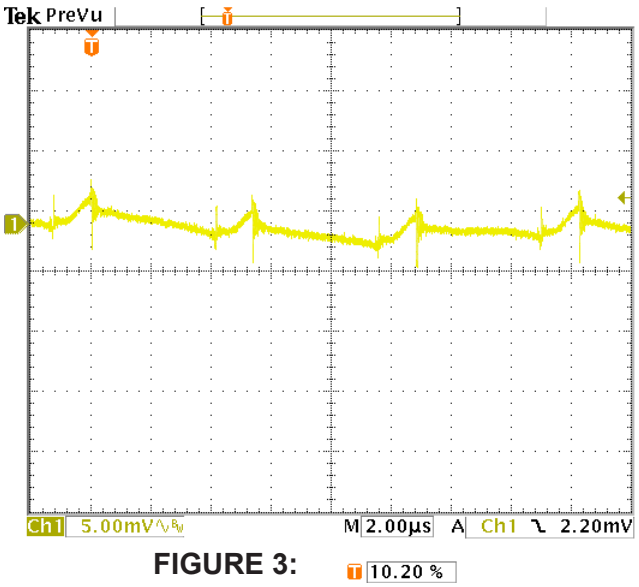


FIGURE 3:

FIGURE 3: Output ripple of Q25S5/24 with another external cap of Nippon Chemi-Con 180µF@16V on the output. The part number is 16PS180MH11.

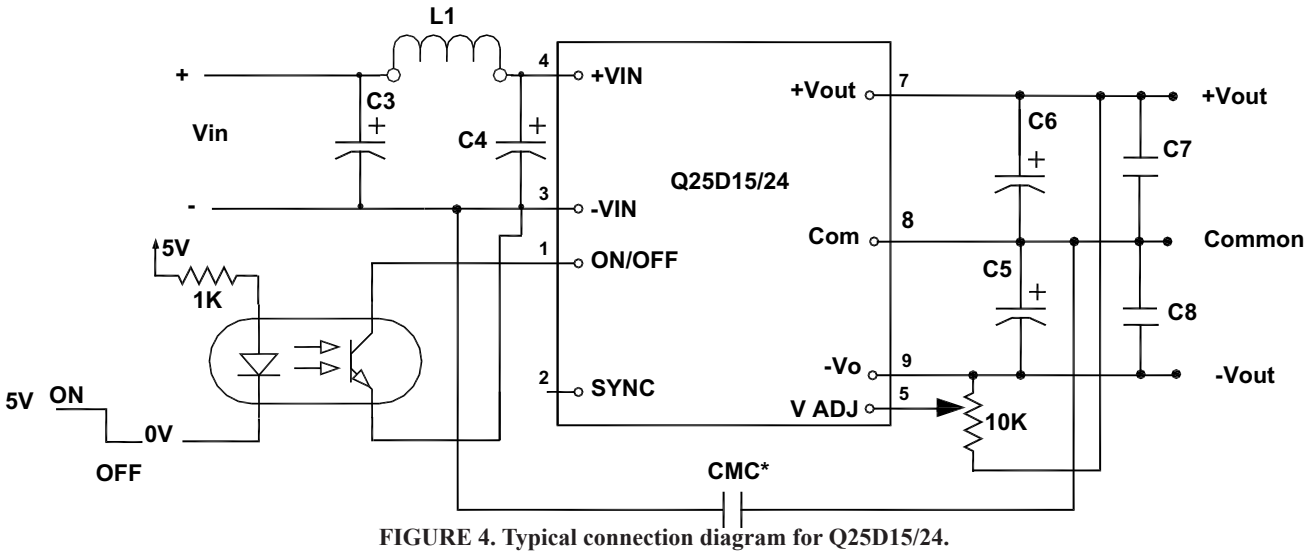


FIGURE 4. Typical connection diagram for Q25D15/24.

Part list for Figure 4:
L1= 2.2µH
C3= 50µF@100V Electrolytic
C4=50µF@100V Electrolytic
C5,C6=47µF@20V Low ESR Tantalum
C7,C8=2.2µF@25V Ceramic Capacitor

CMC*=Common Mode Capacitor
CMC= .01µF@Vcmc
Vcmc >= than required isolation, voltage can be up to

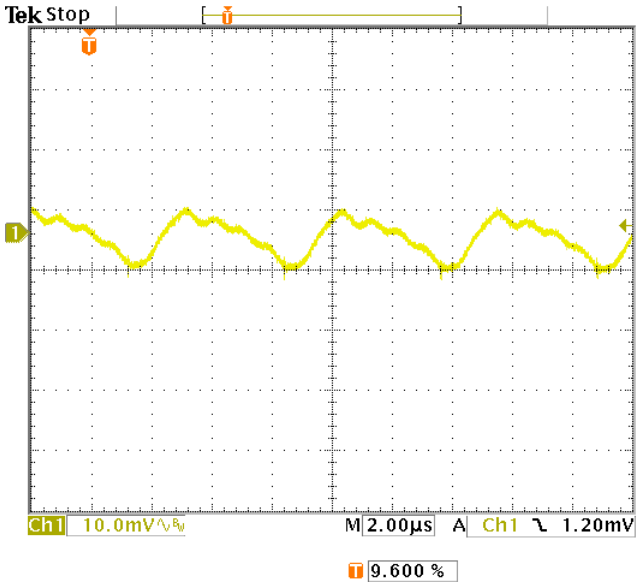


FIGURE 5:

FIGURE 5: Output ripple of Q25D15/24 on +Vout as shown in Figure 4.

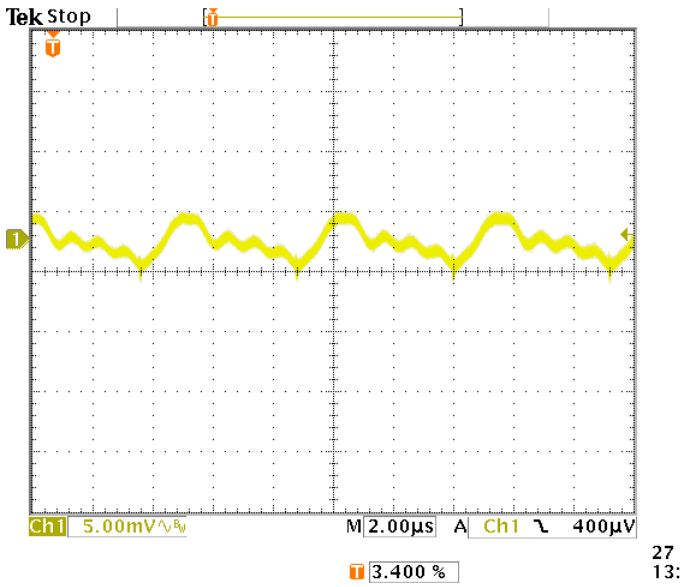


FIGURE 6:

FIGURE 6: Output ripple of Q25D15/24 on +Vout with another external cap of Nippon Chemi-Con 180µF@16V on the +Vout. The part number is 16PS180MH11.

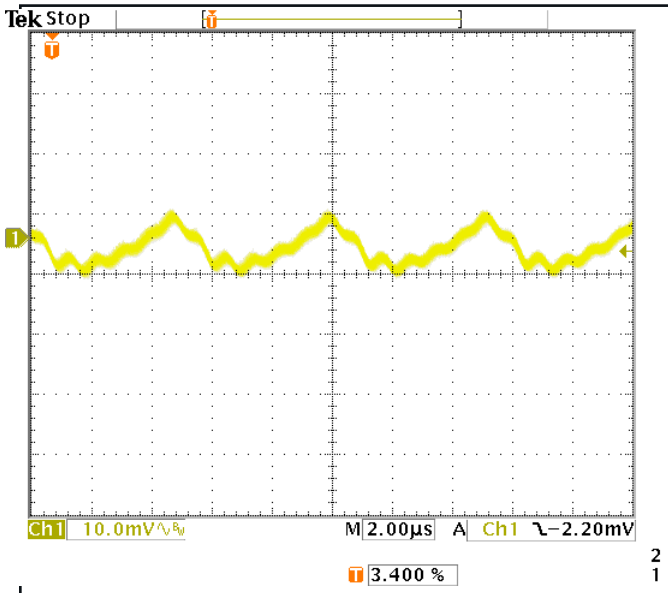


FIGURE 7:

FIGURE 7: Output ripple of Q25D15/24 on -Vout as shown in Figure 4.

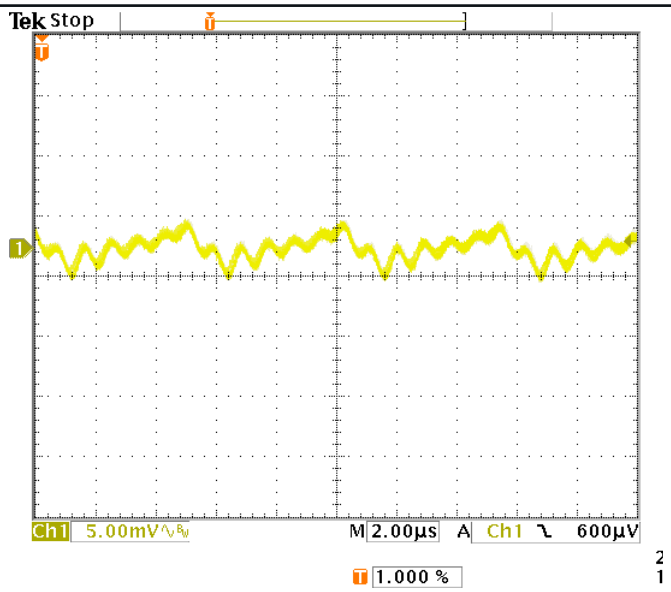


FIGURE 8:

FIGURE 8: Output ripple of Q25D15/24 on -Vout with another external cap of Nippon Chemi-Con 180µF@16V on the -Vout. The part number is 16PS180MH11.

EXTERNAL SYNCHRONIZATION

The SYNC pin can be used to synchronize the internal oscillator to external clock. An open drain output is the recommended interface between the external clock to the Q25 SYNC pin as shown in figure 7. The clock pulse width must be greater than 15ns. The external clock frequency must be greater than the frequency of the Q25.

Multiple Q25 converters can be synchronized together simply by connecting the converters SYNC pins together as shown in figure 8. Care should be taken to ensure the ground potential differences between the converters are minimized. In this configuration all the converters will be synchronized to the highest frequeny device. The SYNC pin is a CMOS buffer with pull-up current limited to 200micro amps. If the external device forces the SYNC pin low before the internal oscillator ramp completes its charging cycle, the ramp will reset and another cycle begins. If the SYNC pins of multiple Q25 converters are connected together, the first SYNC pin that pulls low will reset the oscillator ramp of all the other converters. All converters will operate in phase when synchronized using the SYNC feature. Up to five devices can be synchronized using this method.

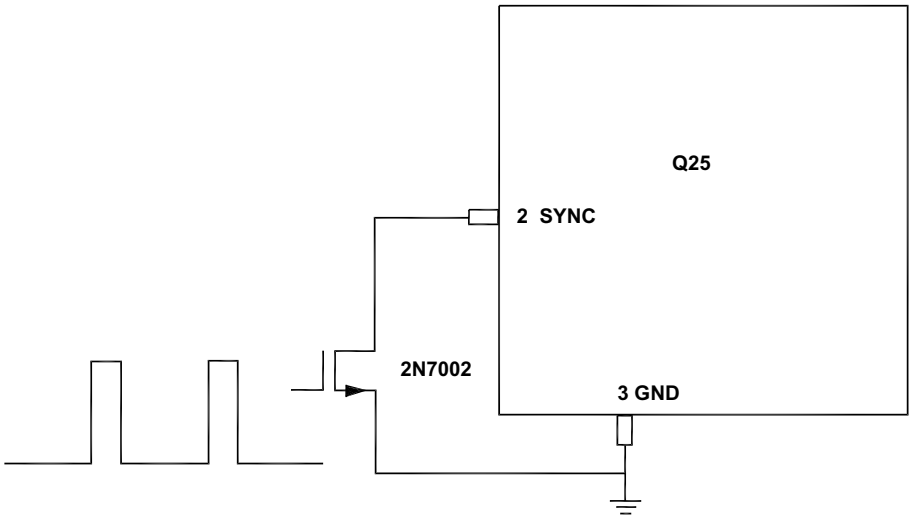


FIGURE 9. SYNC from external clock

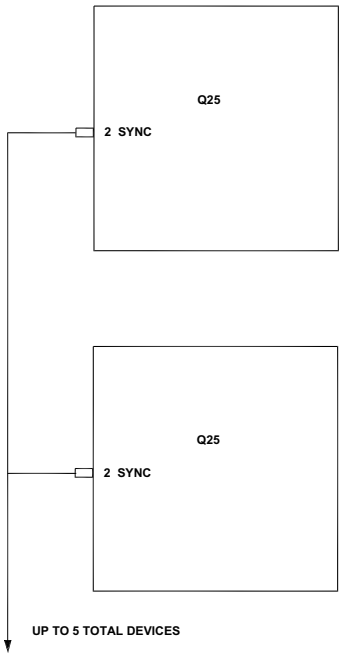


FIGURE 10. SYNC of multiple devices

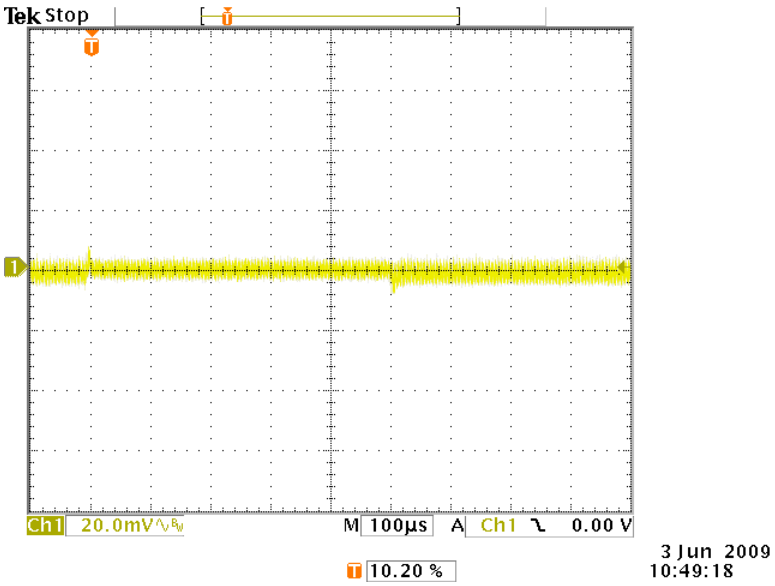


FIGURE 11. Transient Response at Vin=24, Iout changing from Full load to Half load on a Q25S5/24.

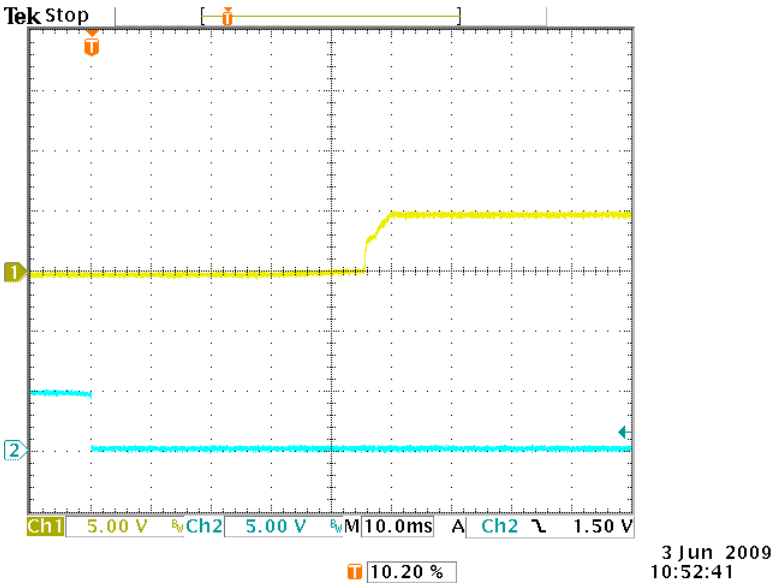


FIGURE 12. Output voltage delay and rise time at Vin=24, Iout=5A using ON/OFF pin on the Q25S5/24.

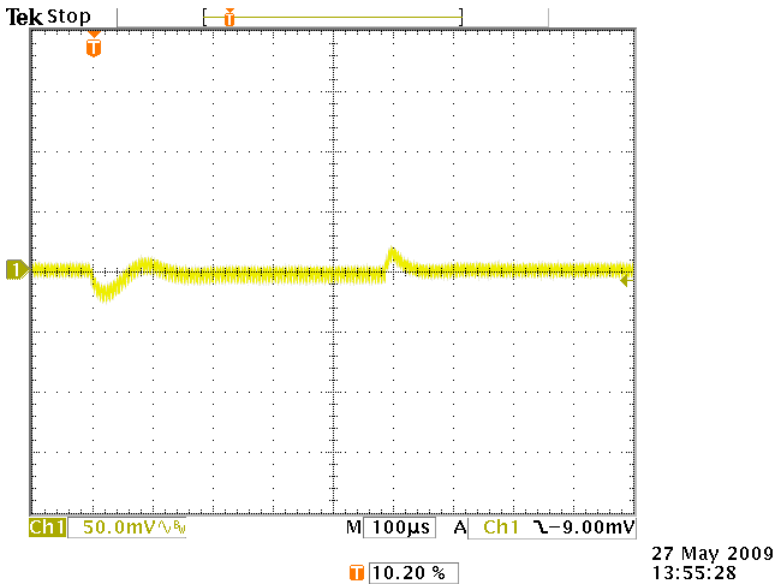


FIGURE 13. Transient Response at Vin=24, Iout changing from Full load to Half load on a Q25D15/24.

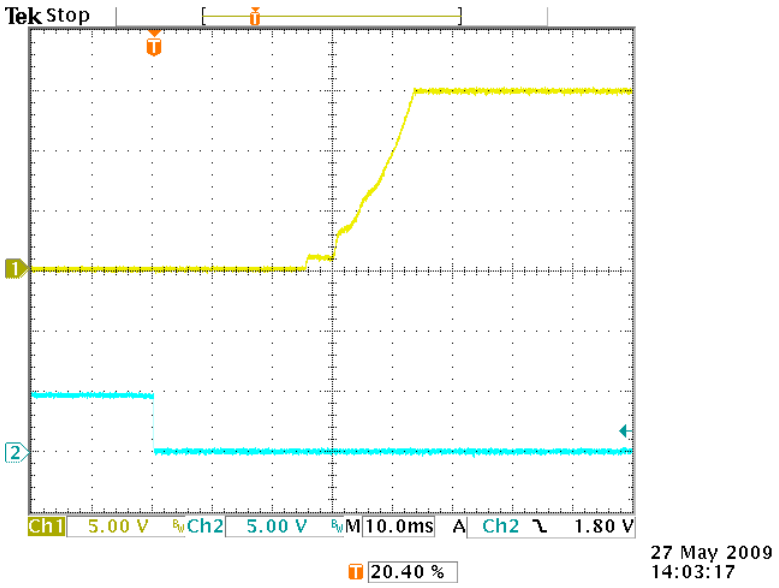
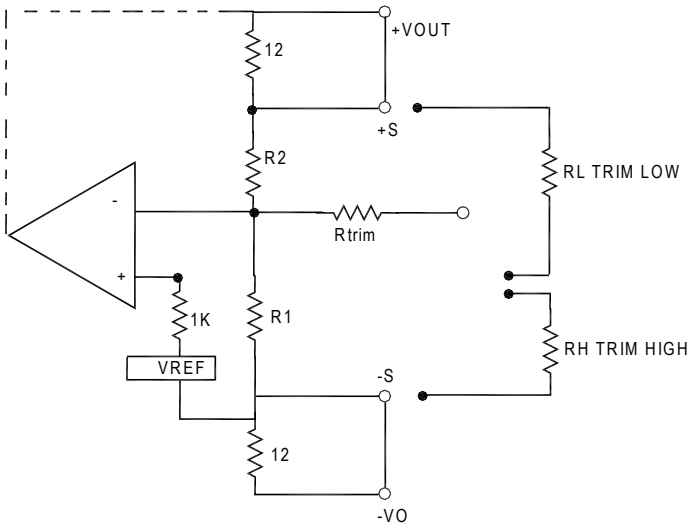


FIGURE 14. Output voltage delay and rise time at Vin=24, Iout at Full load using ON/OFF pin on the Q25D15/24.



NOTE: Vo is the adjusted output voltage

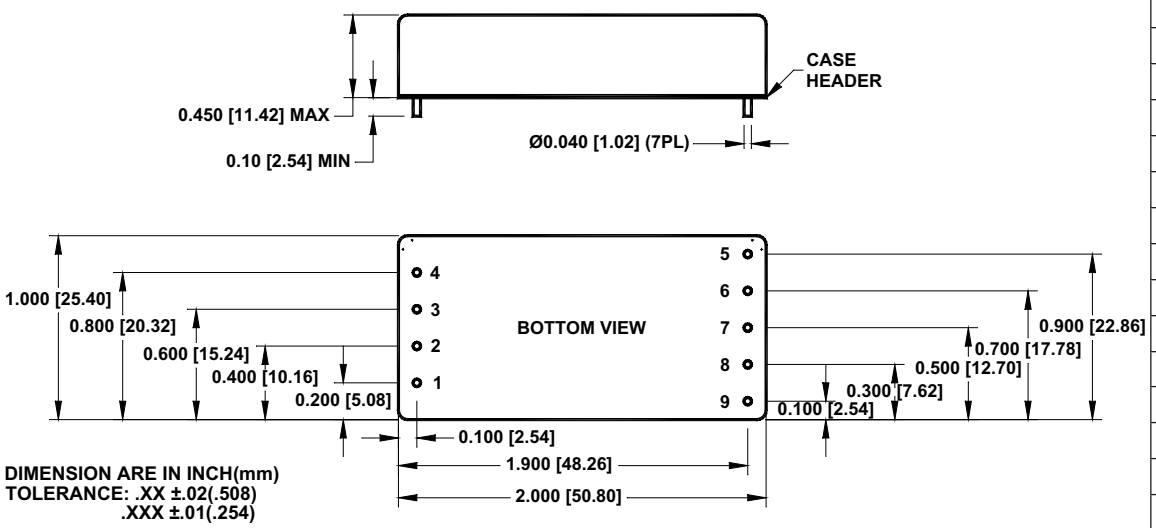
$$RL = \frac{(Vo-Vref)R1*R2}{Vref(R1+R2) - VoR1} - Rt \quad \text{in k}\Omega$$

$$RH = \frac{R1*R2}{\left(\frac{Vo}{Vref} - 1\right)R1 - R2} - Rt \quad \text{in k}\Omega$$

VO	VREF	R2	R1	Rtrim
3.3V	1.225	4.22K	2.49K	15K
5V	2.5	2.49K	2.49K	9.53K
12V	2.5	9.53K	2.49K	20K
15V	2.5	15K	3.01K	23.7K

FIGURE 15. Single Output adjustment equations.

MECHANICAL SPECIFICATIONS



Pin	Function
SINGLE	
INPUT	
1	ON/OFF
2	SYNC IN
3	$-V_{IN}$
4	$+V_{IN}$
OUTPUT	
5	V_{ADJ}
6	+S
7	$+V_{OUT}$
8	$-V_{OUT}$
9	-S
DUAL	
INPUT	
1	ON/OFF
2	SYNC IN
3	$-V_{IN}$
4	$+V_{IN}$
OUTPUT	
5	V_{ADJ}
6	No Pin
7	$+V_{OUT}$
8	Common
9	$-V_{OUT}$