



M.S.KENNEDY CORP.

# 30W TRIPLE DC-DC CONVERTERS

# QCH28515T/ RCH28515T

4707 Dey Road Liverpool, N.Y. 13088

(315) 701-6751

## HI-REL DESIGN

- REPLACES APEX DT28515T/F
- WAVE SOLDERABLE PACKAGE
- ALL CERAMIC CAPACITORS
- NO OPTOCOUPERS
- SURFACE MOUNT MAGNETICS
- WITHSTANDS 3000 G Y1 AXIS
- OVER-VOLTAGE PROTECTION (OVP) OPTION

## OTHER FEATURES – TRIPLE OUTPUT

- NO DERATING – -55°C TO +125°C
- WIDE SUPPLY RANGE – 16 TO 40 VOLTS
- HIGH ISOLATION – 500V
- HIGH POWER DENSITY – 23 W/in<sup>3</sup>
- REMOTE SHUTDOWN
- EXTERNAL SYNCH INPUT (FULLY TTL COMPATIBLE OPTION)

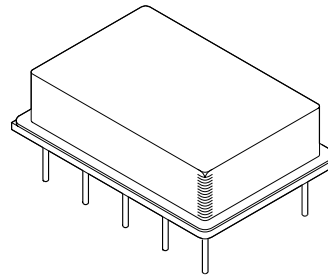
## DESCRIPTION

The QCH28515T/RCH28515T series of DC-DC converters provides the ruggedness, reliability and features required to meet the advanced challenges of today's hi-rel market. This family of converters uses all surface-mounted hybrid components including magnetics, all ceramic capacitors and ultrasonic wirebonds to give long life in full temperature range and high acceleration environments. There is no power derating anywhere in the -55°C to 125°C operating range.

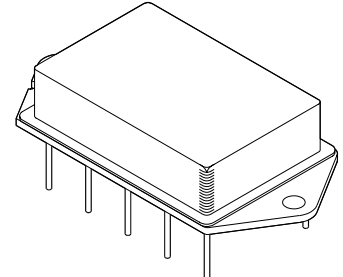
This product family is tolerant of many types of faults including load short, load overload, loss of voltage feedback, large forward and reverse voltages applied to the synchronization pin and input overvoltage. This converter family will operate during input transients to 80 volts. The output voltages have little overshoot during the input voltage transient such that typical logic and linear parts on the outputs will stay well within data sheet absolute maximums.

Other operational features include low duty factor current limit and dynamic current limit threshold. The current limit operates in a cyclic on-off mode with an on time of about 2 milliseconds and an off time of 20 milliseconds for a duty factor of about 10 percent. This limits the converter dissipation to about 1 watt, so there is no danger of overheating during an output fault at 125° C. The dynamic current limit threshold allows over 50 percent more current to flow for a short time after power application, release from shutdown or recovery from previous current limit allowing large load capacitances to be charged during turn-on.

This converter family is a push-pull 400 kHz forward converter with full isolation between the input side, output side and case. This isolation is achieved without optocouplers for an even greater margin of reliability. The converter is housed in a power DIP package and is hermetically sealed. The RCH28515T has tabs for bolting the device down.

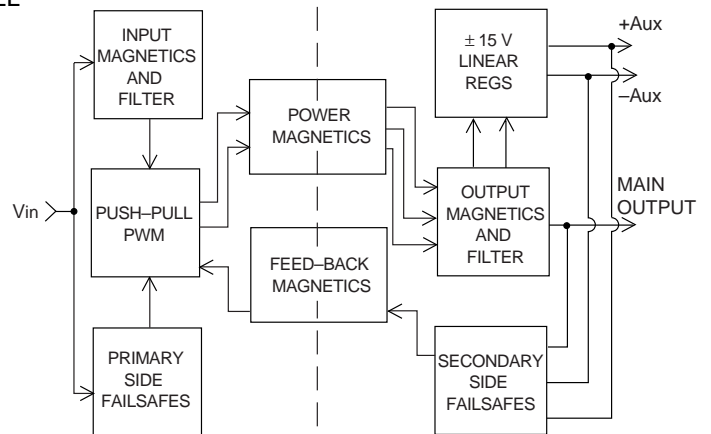


QCH28515T

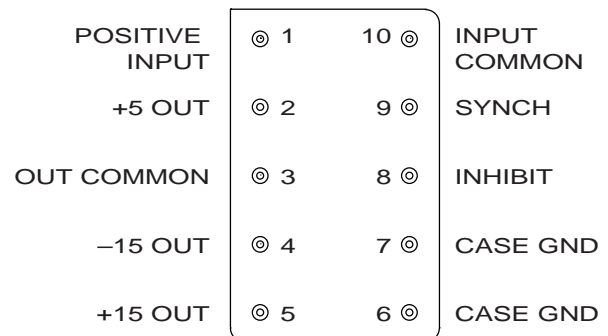


RCH28515T

## BLOCK DIAGRAM



## EXTERNAL CONNECTIONS



## TOP VIEW

# QCH28515T/RCH28515T

## ABSOLUTE MAXIMUM RATINGS SPECIFICATIONS

### ABSOLUTE MAXIMUM RATINGS

INPUT VOLTAGE RANGE  
 INPUT VOLTAGE TRANSIENT RANGE  
 OUTPUT WITHSTAND VOLTAGE  
 STORAGE TEMPERATURE  
 OPERATING TEMPERATURE  
 TEMPERATURE, pin soldering 10 seconds

0 to 50 VDC  
 80V@50mS  
 25 VDC  
 -65 to +150°C  
 -55 to +125°C  
 300 °C MAX

### SPECIFICATIONS

Unless noted:  $-55^{\circ}\text{C} \leq T_{\text{CASE}} \leq 125^{\circ}\text{C}$ ,  $16\text{Vdc} \leq V_{\text{IN}} \leq 40\text{Vdc}$ ,  $P_{\text{MAIN}} = 20\text{W}$ ,  $P_{+\text{AUX}} = P_{-\text{AUX}} = 5\text{W}$ .

PARAMETER	SYMBOL	TEST CONDITIONS	GROUP A <sup>12</sup> SUBGROUP	MIN	TYPICAL	MAX	UNITS	COMMENT	
INPUT VOLTAGE	$V_{\text{IN}}$	No load to full load	1, 2, 3	0	28	50	Vdc	Normal Operating <sup>1</sup> Transient	
				16		40			
				50		80			
UVLO	$V_{\text{UVLO}}$		1, 2, 3	10	12.5	14	Vdc		
INPUT CURRENT	$I_{\text{IN}}$	NoLoad	1, 2, 3		0.12		Adc		
		Full load <sup>2</sup>		1.25	1.57	1.65			
		Inhibited		0.0001	0.002	0.005			
OUTPUT CURRENT <sup>3</sup>	$I_{\text{MAIN}}$		1		4.00	6.00	Adc		
			2, 3						
	$I_{+\text{AUX}}$		1		0.33	0.66			
			2, 3						
	$I_{-\text{AUX}}$		1		-0.33	-0.66			
			2, 3						
OUTPUT VOLTAGE <sup>2,4</sup>	$V_{\text{MAIN}}$		1	4.95	5.0	5.05	Vdc		
			2, 3						
	$V_{+\text{AUX}}$		1	14.85	15.00	15.15			
			2, 3						
	$V_{-\text{AUX}}$		1	-14.85	-15.00	-15.15			
			2, 3						
OVP <sup>4</sup>	$V_{\text{OVP}}$		1	5.3	5.6	5.9	Vdc		
			2, 3	5.14		6.10			
OUTPUT POWER	$P_{\text{OUT}}$		$P_{\text{MAIN}}$	1, 2, 3	0	20	30	W	
			$P_{\pm\text{AUX}}$		0	10	20		
			$P_{\text{TOT}}$		0		30		
EFFICIENCY <sup>2</sup>	$\eta$		$P_{\text{OVERLOAD}}$	1		63		%	
		2, 3							
LINE REGULATION	$VR_{\text{LINE}}$	$V_{\text{IN}}$ 16-40V	1		5	10	mV	Main	
			2, 3		10	50			
			1		50	75		Aux	
			2, 3		120	150			
LOAD REGULATION	$VR_{\text{LOAD}}$	$I_{\text{MAIN}}$ 0↔4A	1		5	20	mV	Main	
			2, 3		20	50			
			$\pm I_{\text{AUX}}$ 0↔0.33A	1		50	75		Aux
				2, 3		150	250		

SPECIFICATIONS

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PARAMETER	SYMBOL	TEST CONDITIONS	GROUP A <sup>12</sup>			UNITS	COMMENT	
			MIN	TYPICAL	MAX			
CROSS REGULATION	VR <sub>CROSS</sub>	$\pm I_{\text{AUX}}$	1	5	20	mV	Main	
		$0 \leftrightarrow 0.33\text{A}$	2, 3	20	50			
		$I_{\text{MAIN}}$	1	50	75			$\pm\text{Aux}$
		$0 \leftrightarrow 4\text{A}$	2, 3	150	250			
CURRENT LIMIT	I <sub>LIM</sub>		1	115	125	%		
LOAD FAULT POWER	P <sub>D</sub>	Overload <sup>6</sup>	1, 2, 3	14	25	W		
		Short Ckt.		6				
INHIBIT PIN VOLTAGE <sup>7</sup>	V <sub>ENH</sub>	Enabled	1, 2, 3	12	16.8	V dc		
	V <sub>ENL</sub>	Inhibited		0	5			
INHIBIT PIN CURRENT <sup>7</sup>	I <sub>ENH</sub>	Enabled	1, 2, 3	0	10	$\mu\text{A}$ dc		
	I <sub>ENL</sub>	Inhibited		650	1200			
ISOLATION	R <sub>ISO</sub>	500V dc	1, 2, 3	100		Meg $\Omega$	Primary to Secondary to Case	
CAPACITIVE LOAD	C <sub>L</sub>		1, 2, 3	330	500	$\mu\text{F}$	Main	
				10	22			$\pm\text{Aux}$
INPUT CURRENT RIPPLE <sup>2</sup>	I <sub>RIP</sub>		1	100		mA rms		
			2, 3	120	250			
OUTPUT VOLTAGE RIPPLE	V <sub>RIP</sub>		1	15	45	mV rms	Main	
			2, 3	30	90			
			1	12	36			$\pm\text{Aux}$
			2, 3	25	75			
SWITCHING FREQUENCY	F <sub>SW</sub>		4, 5, 6	350	400	450	kHz	
SYNC. FREQUENCY	F <sub>SYNC</sub>		4, 5, 6	300		650	kHz	
SYNC. PIN VOLTAGE <sup>8</sup>	V <sub>HI</sub>		1, 2, 3	2.4	-		V dc	
	V <sub>LO</sub>			-		0.4		
SYNC. PIN CURRENT	I <sub>SYN<sup>H</sup></sub>		1, 2, 3		-400		$\mu\text{A}$ dc	
	I <sub>SYN<sup>L</sup></sub>				-500	-750		
TURN ON TIME <sup>9</sup>	T <sub>ON</sub>		4	4	8		mS	
TURN ON OVERSHOOT	VT <sub>ON</sub>	C <sub>L</sub> =0	4	0	300	mVdc	Main	
			4		900			$\pm\text{Aux}$
STEP LOAD TRANSIENT, RESPONSE	VT <sub>LOAD</sub>	C <sub>L</sub> =0, I <sub>MAIN</sub> =50 $\leftrightarrow$ 100%	1	-800	+800	mVdc	Main	
		C <sub>L</sub> =0, I <sub>AUX</sub> =50 $\leftrightarrow$ 100%	1		500			750

# QCH28515T/RCH28515T

## SPECIFICATIONS

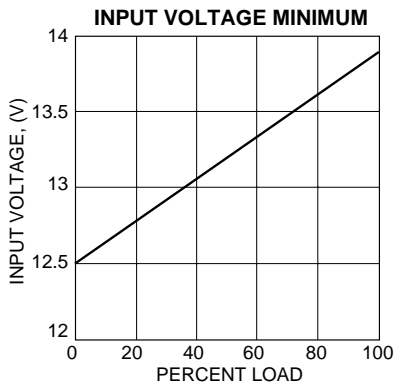
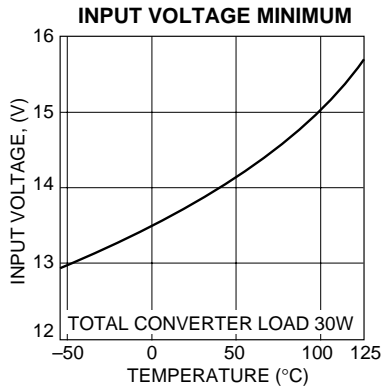
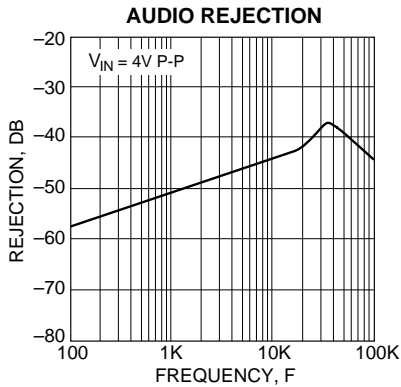
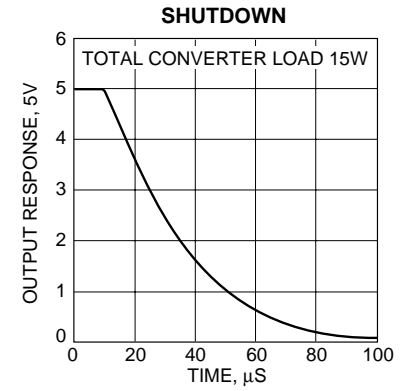
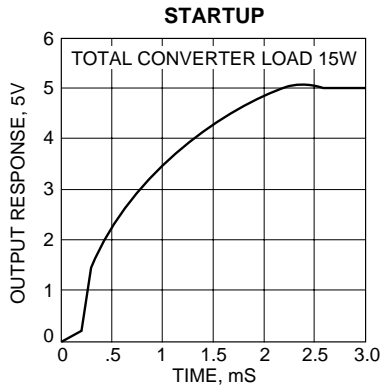
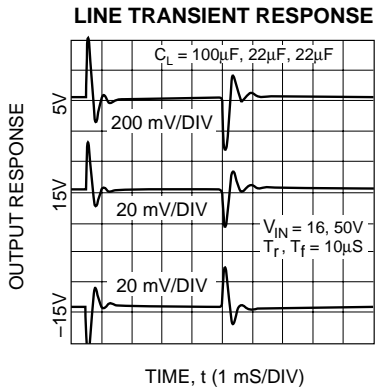
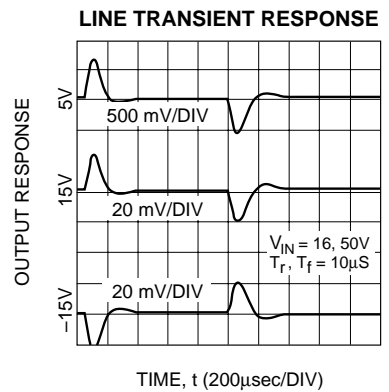
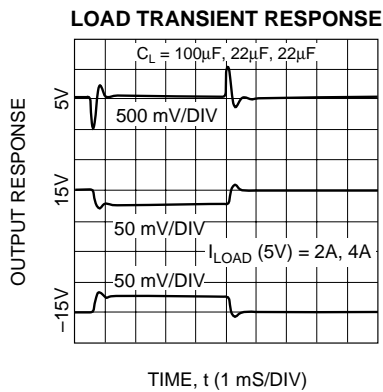
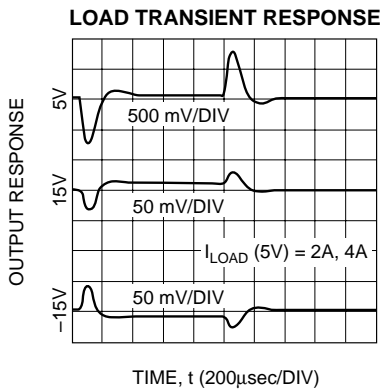
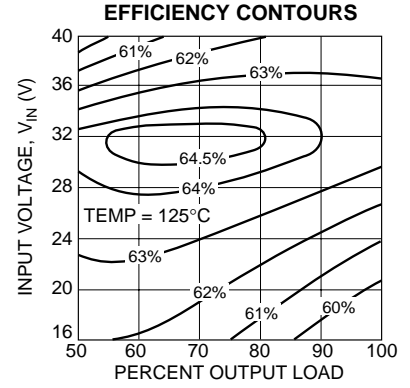
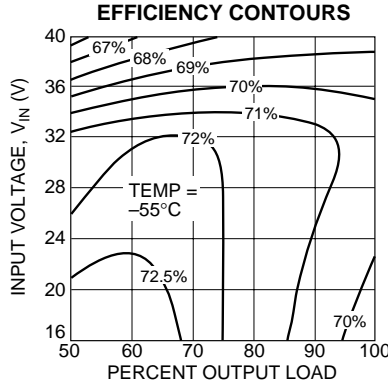
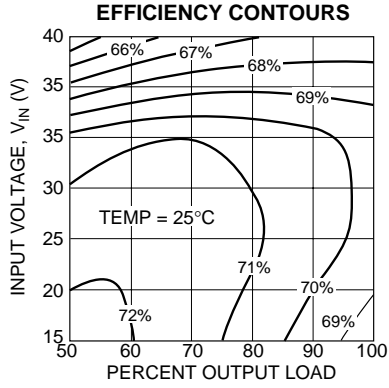
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PARAMETER	SYMBOL	TEST CONDITIONS	GROUP A <sup>12</sup>		MAX	UNITS	COMMENT
			MIN	TYPICAL			
STEP LOAD TRANSIENT <sup>10</sup> RECOVERY	TR <sub>LOAD</sub>	C <sub>L</sub> =0	4	0.05	0.10	mS	Main
			4	3	5		±Aux
STEP LINE TRANSIENT, RESPONSE	VT <sub>LINE</sub>	C <sub>L</sub> =0	1	150	250	mVdc	Main
			1	100	250		±Aux
STEP LINE TRANSIENT <sup>10</sup> RECOVERY	TR <sub>LINE</sub>	C <sub>L</sub> =0	4	0.05	0.10	mS	Main
			4	3	5		±Aux
LOAD FAULT TRANSIENT, RESPONSE	VT <sub>FLT</sub>	C <sub>L</sub> =0	1	0	300	mVdc	Main
			1		900		±Aux
LOAD FAULT TRANSIENT <sup>10</sup> , RESPONSE	TR <sub>FLT</sub>	C <sub>L</sub> =0	4	40	100	mS	Main
			4		TBD		±Aux
INHIBIT DELAY <sup>11</sup>	TD <sub>INH</sub>	C <sub>L</sub> =0	4	0.1	0.2	mS	Main
			4		TBD		±Aux
INHIBIT RECOVERY <sup>9</sup>	TR <sub>INH</sub>	C <sub>L</sub> =0	4	4	8	mS	Main
			4		TBD		±Aux

- NOTES: 1. Under Voltage Lock Out (UVLO) is approx. 10.5-13.5 Vdc.  
2. Vin = 28±1 V dc. Nominal output power: P<sub>MAIN</sub> = 20W, P<sub>+AUX</sub> = 5W, P<sub>-AUX</sub> = 5W.  
3. Full power output must be equal to or less than 30 watts. Short duration Aux current is 2A peak.  
4. Over-Voltage Protection (OVP) guaranteed by design not to exceed 6V dc on main output under any static condition at room temperature. On models with OVP option, only. Therefore this parameter is limited to <5.5V on these models.  
5. Short Term Over-Load (STOL).  
6. Continuous overload. Auxiliary outputs are protected with thermal shutdown.  
7. Internal Pull-Up typically 22k ohms to V<sub>IN</sub>. For 80-volt transients, input device must be able to sink at least 3.5 mA.  
8. Internal Pull-Up approximately 22k ohms to typically 12V. This is an open collector, TTL compatible, edge triggered active low input. A valid low must exist for 20% to 80% duty ratio. The converter takes approximately 2 mS to synchronize. For "TTL Sync" option V<sub>MAX</sub> ≤ 55V.  
9. Time for outputs to reach 90% of final value. Measured from valid Inhibit High V<sub>ENH</sub> or valid V<sub>IN</sub>.  
10. Measured from start of transient to response within 90% of final value.  
11. Time for outputs to reach 50% of initial value. Measured from valid Inhibit Low V<sub>ENL</sub> or V<sub>IN</sub> below UVLO.  
12. As per MIL-PRF-38534.

# QCH28515T/RCH28515T

## TYPICAL PERFORMANCE GRAPHS



## SYNCHRONIZATION

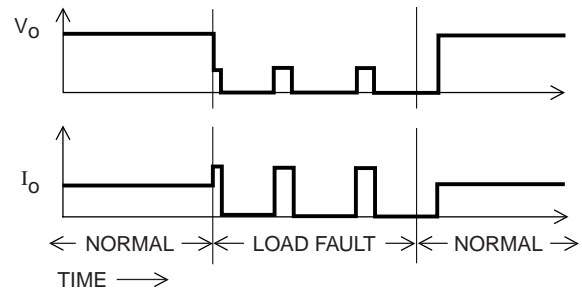
The synch pin allows the converter to be synchronized in frequency and phase with an external signal. This signal should be TTL compatible ( $0.8 \text{ max } V_{\text{INL}}$  and  $2.0 \text{ V min } V_{\text{INH}}$ ). Overdrive up to 10V is not harmful. Transient voltage withstand is  $\pm 50\text{V}$  with respect to input common. The frequency applied to this pin must be between 350 and 600 kHz with duty factor anywhere from 20 to 80 percent.

## SHUTDOWN

The shutdown pin turns off the power conversion circuits and puts the converter in standby mode. The shutdown pin is referenced to the input common pin. In standby mode the converter only draws 2.2 mA typical (5.0 mA maximum) input current from  $V_{\text{IN}}$ . For normal operation this pin should be open circuited and allowed to float. For shutdown pull this pin below 1 volt. The maximum open circuit voltage that will appear on this pin is 15 volts. See graphs for typical time response of the converter to assert and release shutdown.

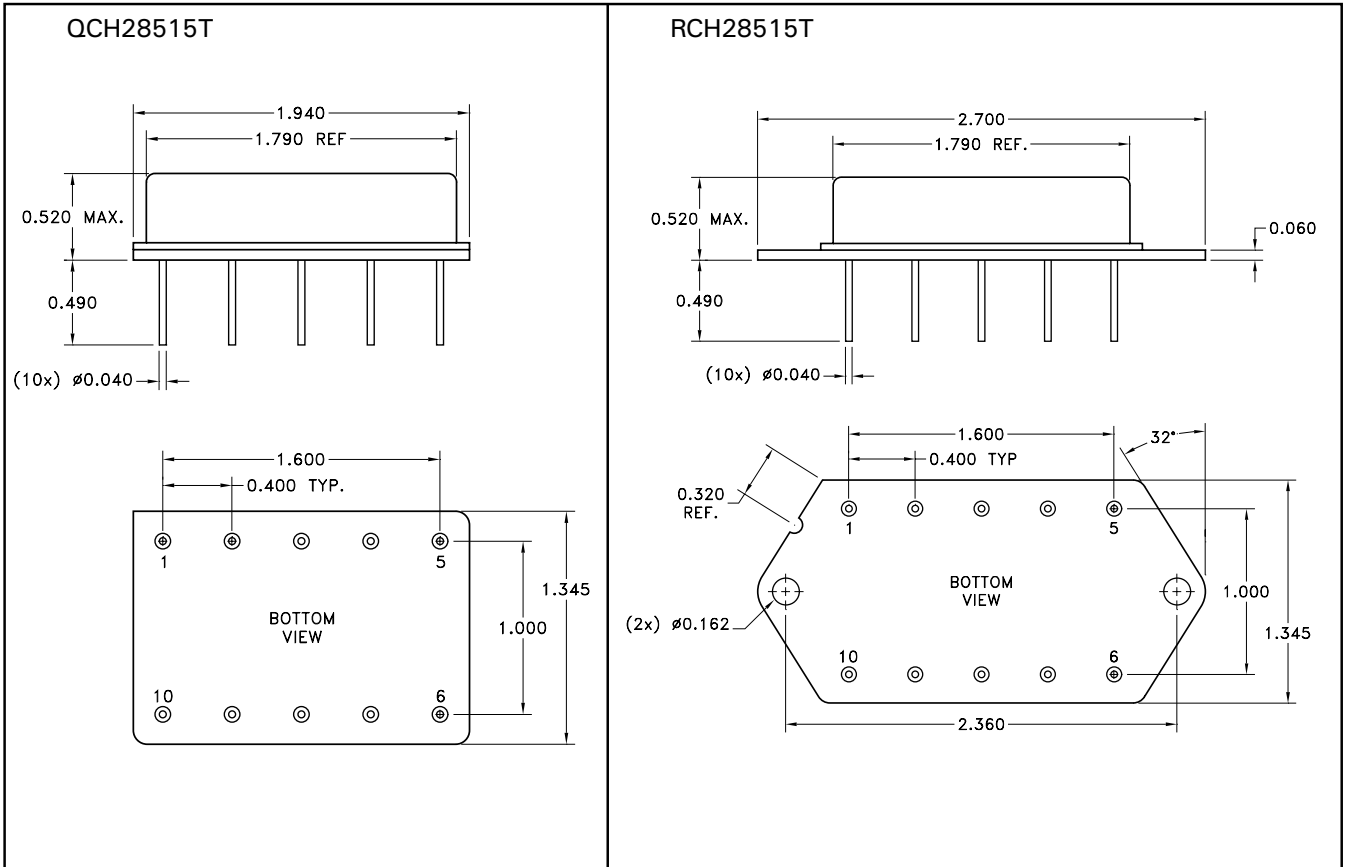
## LOAD FAULT RESPONSE

The QCH28515T/RCH28515T family of DC-DC converters use a common fault protection approach. Load fault conditions include short-circuit and overload conditions. The QCH28515T/RCH28515T converters respond to load faults on the main output (+5V) by turning off all power conversion circuits for a period of time and then attempting to restart. The figure below shows the fault protection response to an output overload, the turn on plus detect fault time is typically two milliseconds and the off time is typically twenty milliseconds. The net "on" duty factor during a fault is only 10 percent, resulting in low converter dissipation and immunity from overheating at 125°C. An added benefit to this method is that the amount of output current that defines a fault is programmed to increase by 1.5X during the first few hundred microseconds of operation after power-up, load fault recovery or release of the shutdown pin. This allows QCH28515T/RCH28515T converters to bring up capacitive and other difficult loads more reliably than some competing converters.



The auxiliary outputs have individual overcurrent protection and independent fault protection. A rapid response thermal shutdown feature adds to the reliability of the converter by protecting each auxiliary output from load faults. Substantial current may be drawn from either auxiliary output but is limited to safe levels by independent current sensing circuitry on each. If the fault or overload continues for extended periods the thermal shut down circuitry will cycle the output to limit the maximum internal hotspot temperature to a safe level.

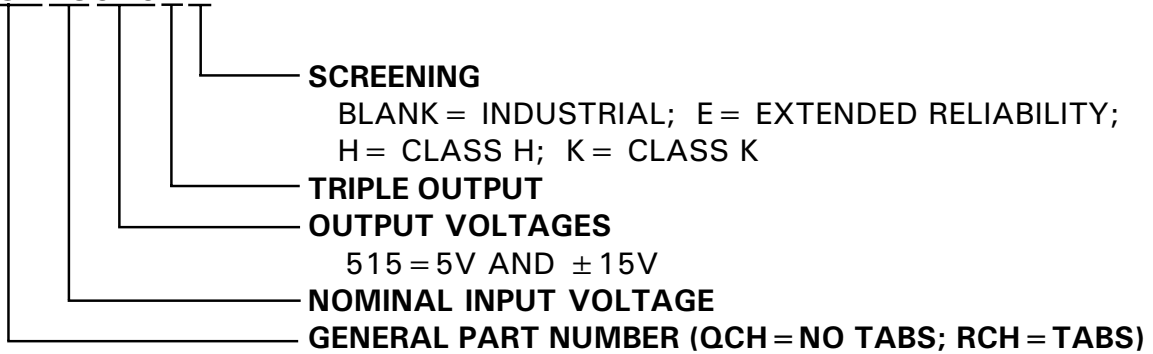
MECHANICAL SPECIFICATIONS



NOTE: ALL DIMENSIONS ARE  $\pm 0.010$  INCHES UNLESS OTHERWISE LABELED.  
ESD Triangle indicates Pin 1.

**ORDERING INFORMATION**

**QCH28515T**



The above example is an industrial grade 5V and  $\pm 15V$  triple output converter without tabs

M.S. Kennedy Corp.  
4707 Dey Road, Liverpool, New York 13088  
Phone (315) 701-6751  
FAX (315) 701-6752  
www.mskennedy.com

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