

**RICHTEK**

# **Richtek Automotive Product Selection Guide**

Wide ranges of automotive power ICs  
in different applications

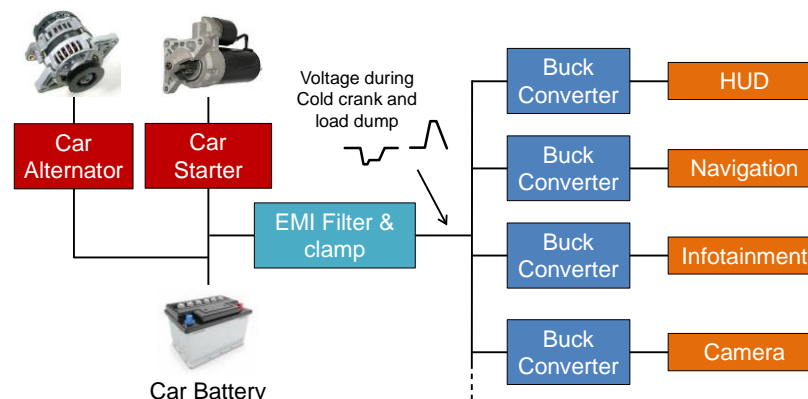
Oct 2016

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### Introduction

Designing power solutions for automotive applications requires special care of several conditions that are specific for automotive environment: The very wide operating temperature range, input voltage fluctuations and stringent requirements on EMI/noise generation due to the nearby car radio receiver. Therefore, automotive applications require high reliability and good safety protections. Richtek has launched robust automotive products and design tools that simplify the automotive power design considerably.



### Richtek Automotive Power Solutions

Richtek provides the wide range automotive solutions from DC/DC converters, LDOs, power switch, PMICs to LED drivers for the variety of automotive/industrial applications. Featuring input operating voltage up to 40V and output current up to 4A, Richtek automotive products with high performance and reliability in effectively thermal packages have successfully been selected by automotive manufacturers worldwide.

### Key Features of Richtek Automotive products

- Richtek offers both AEC-Q100 Grade 1, 2 & 3 qualified and automotive/industrial standard products for automotive applications. Based on AEC-Q100 guidelines, products which meet AEC-Q100 qualification are clearly designated in Richtek product datasheets and marked as Grade 3 operating from -40°C to 85°C, Grade 2 operating from -40°C to 105°C and Grade 1 operating from -40°C to 125°C. AEC-Q100 is a failure mechanism based stress test for automotive packaged integrated circuits. It was defined by major automotive manufacturers as a common part-qualification.

## Wide ranges of automotive power ICs from Richtek in different applications:

- Infotainment: Controller operating panel (HMI) and display, head-up display, head unit, Audio, Video, navigation (AVN) and others.
- Advanced Driver Assistance Systems: Multi-camera system with central processing (AVM), Ultrasonic parking assist, front long range radar, rear and front camera, and others.
- Others including Power Switch and LED lighting solutions.

## Automotive Design Considerations

Richtek automotive products are defined as two major categories for different applications: products with input voltage up to 40V and input voltage up to 5.5V.

- Products connected to the vehicle battery rails require 36V input voltage to support load dump and down to 4.5V for start-stop. The output voltages of systems normally range from 1.8V to 5V. In some cases such as cold-crank where battery rail can drop as low as 3V during cranking of the engine, it is not possible to maintain regulation when input voltage approaches the regulated voltage, and some voltage drop is allowed.
- Devices for vehicle interface processors in subsystems require input voltage up to 5.5V. The vehicle subsystem monitors temperature, voltage levels, etc.
- A radio receiver nearby has high sensitivity in electromagnetic fields in its operating bands, and will easily be affected by converter switch noise. Selecting a suitable switching frequency can help to avoid radiating noise in sensitive frequency bands. Richtek provides products with programmable switching frequency, which allows best trade-off between efficiency and component size. Some products with external clock synchronization can be set to avoid sensitive frequency bands and shift the second harmonic out of the tuned frequency band.
- Richtek also provides products with the low quiescent and low shutdown current, which is ideal for devices in standby mode.

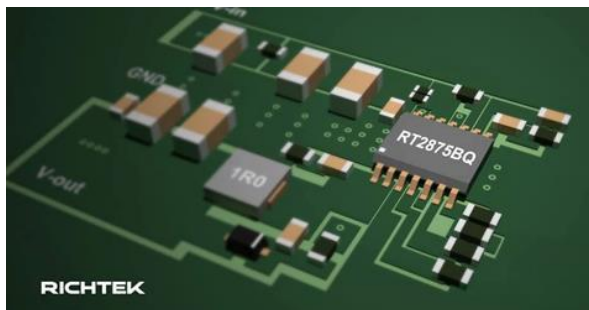
AEC-Q100 qualified	Buck converters	LDO	PMIC	LED Driver	Others: Power Switch & DDR termination regulator
Up to 36V input	Grade 2 & 3	Grade 3	Grade 1	Grade 3	
Up to 5.5V input	Grade 3	Grade 3			Grade 1 & 3

## Component recommendations

### AEC-Q100 Solutions – up to 40V car battery input

Buck Converters									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 2	<a href="#">RT2875</a> <a href="#">Richtek Designer™</a>	4.5V	36V	0.6V-24V	3A	300k-2.1MHz (adj.)	-40°C to 105°C	<ul style="list-style-type: none"> <li>• Adj. I<sub>LIM</sub>: 1.5A-6A</li> <li>• 100% duty-cycle low dropout mode</li> <li>• Ext. sync. &amp; ext. comp.</li> <li>• Soft-Start and Power Good</li> </ul>	PTSSOP-14
AEC-Q100 Grade 3	<a href="#">RT2872</a> <a href="#">Richtek Designer™</a>	4.5V	36V	0.8V-30V	3A	300k-1MHz (adj.)	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Ext. comp.</li> </ul>	PSOP-8

#### RT2875 Automotive Buck application note



- Component value calculation
- Tolerance Analysis
- Thermal calculation
- EMI solution
- [Richtek Designer Simulation Tool](#)
- PCB layout guideline



LDO									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub>	I <sub>OUT</sub>	dropout	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 3	<a href="#">RT2560Q</a>	3.5V	36V	2.5V, 3.5V, 5V, 12V (fixed)	100mA	0.55V@10mA	-40°C to 85°C	<ul style="list-style-type: none"> <li>Ultra-low I<sub>Q</sub> : 2μA</li> </ul>	PSOP-8

LED Drivers									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	LED current	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 3	<a href="#">RT8577A</a>	5.5V	40V	Up to 45V	20mA-120mA (4CH)	200k-2.1MHz (adj. Boost controller)	-40°C to 85°C	<ul style="list-style-type: none"> <li>Ext. MOSFET</li> <li>PWM dimming</li> <li>±1.5% channel current matching</li> </ul>	WQFN-20L 5x5
AEC-Q100 Grade 3	<a href="#">RT8494</a>	4.5V	36V	Up to 90V	Limited by Ext. MOSFET	100k-1MHz	-40°C to 125°C	<ul style="list-style-type: none"> <li>Ext. MOSFET</li> <li>Buck, Boost, Buck-Boost multi-topology LED driver</li> <li>Analog/ PWM dimming</li> <li>Adj. Soft-Start and adj. over-voltage protection</li> </ul>	SOP-14

PMIC – 3 Channel DC/DC Converters + LDO + Load Switch PMIC with I <sup>2</sup> C interface for car infotainment and automotive/industrial camera modules									
	Part number	V <sub>IN</sub> range		I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package	
AEC-Q100 Grade 1	RT2070	CH1: 4.5V-15V		2A	2MHz	-40°C to 125°C	<ul style="list-style-type: none"> <li>I<sup>2</sup>C control to set timing of power on/off, sequence and discharge function, and includes power good indicator.</li> <li>Sequence controlled by setting the resistances of the SEQ Pin</li> </ul>	WQFN-24L 4x4	
		CH2/3: 2.7V-5.5V		1A	2MHz				
		LDO: 2.7V-5.5V		0.5A					
		Load Switch: 2.7V-5.5V		0.5A					

### AEC-Q100 Solutions – up to 5.5V input

Buck Converters									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 2	<a href="#">RT5701</a>	2.5V	5.5V	0.3V-5.5V	4A	3MHz	-40°C to 105°C	<ul style="list-style-type: none"> <li>• I<sup>2</sup>C control for V<sub>out</sub> level, peak current limit, PWM control, etc.</li> <li>• Support Dynamic Voltage Scaling (DVS)</li> <li>• 1V/1.5V default output</li> <li>• Auto PSM/PWM or Force PWM</li> </ul>	PTSSOP-14
AEC-Q100 Grade 3	<a href="#">RT2657BQ</a>	2.7V	5.5V	0.6V-5.5V	0.6A	2.25MHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• I<sub>LIM</sub> : 1.5A(typ.) /0.8A(min.)</li> <li>• No schottky diode required</li> <li>• Forced PWM</li> <li>• 100% duty cycle</li> </ul>	WDFN-8L 3x3

Buck Converters									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 3 & Automotive Standard*	<a href="#">RT2101A</a> <a href="#">RT2101B</a>	2.95V	6V	0.827V-3.3V	3A <a href="#">RT2101A</a> 2A <a href="#">RT2101B</a>	700kHz-2MHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Adj. soft-start</li> <li>• Power Good indicator</li> <li>• Ext. synchronous</li> </ul>	WQFN-16L 3x3

\*under Japanese automotive system manufacturer proprietary qualification

LDO									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub>	I <sub>OUT</sub>	Dropout	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
AEC-Q100 Grade 3	<a href="#">RT2517B</a>	2.2V	6V	1.2V-(V <sub>IN</sub> - V <sub>Drop</sub> )	1A	0.2V@1A	-40°C to 85°C	<ul style="list-style-type: none"> <li>• EN pin</li> <li>• 1.2V ± 2% V<sub>REF</sub></li> </ul>	PSOP-8

Power Switch									
	Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	I <sub>OUT</sub>	R <sub>DS(ON)</sub>	(T <sub>A</sub> ) Ambient temp. range	Key features	Package	
AEC-Q100 Grade 3	<a href="#">RT2528</a>	2.5V	5.5V	2.5A	120mΩ	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Adj. I<sub>LIM</sub> : 0.5A-2.5A</li> <li>• 120μA low supply current</li> <li>• FAULT pin</li> </ul>	PSOP-8	

DDR Termination Regulator									
	Part number	V <sub>LDOIN</sub>	Sink/source	(T <sub>A</sub> ) Ambient temp. range	Key features	Package			
Automotive Standard*	<a href="#">RT2526Q</a>	1.2V-1.8V	2A	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Support DDRII, DDRIII and low power requirement</li> <li>• integrated sleep-state controls placing VTT in High-Z in S3 (suspend to RAM)</li> <li>• Remote sensing (VTTSENS)</li> <li>• ±20mV Accuracy for VTT and VTTREF &amp; 10mA reference output</li> </ul>	PSOP-8			
AEC-Q100 Grade 1 Automotive Standard*	<b>RT2536QA</b>	1V-3.5V	2A	-40°C to 125°C	<ul style="list-style-type: none"> <li>• Support DDRI, DDRII, DDRIII, DDRIII-L, DDR IV and LPDDRIV applications</li> <li>• Remote sensing</li> <li>• 10mA reference output</li> </ul>	WDFN-10SL 3x3			


\*under Japanese automotive system manufacturer proprietary qualification



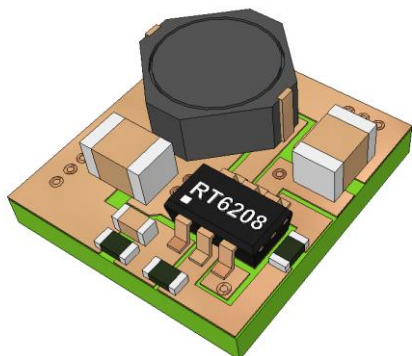
### Also see wide Vin range products for industrial and commercial applications

Buck Converters								
Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
<a href="#">RT6204</a> <sup>new!</sup>	5.2V	60V	0.8V-50V	0.5A	350kHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Adj. soft start</li> <li>• ±1.5% accuracy V<sub>REF</sub></li> <li>• Ext. compensation</li> </ul>	PSOP-8

Buck Converters								
Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
<a href="#">RT6208</a>	4.75V	36V	V <sub>FB</sub> = 0.8V	0.1A	Hysteresis mode control	-40°C to 85°C	<ul style="list-style-type: none"> <li>• ±1% V<sub>FB</sub></li> <li>• Boundary Conduction Mode for high efficiency</li> <li>• Ideal for MCU supply</li> </ul>	SOT-23-6 SOT-23-8
<a href="#">RT6200</a>	4.5V	36V	0.8V-15V	0.6A	1.2MHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• 95% duty cycle</li> <li>• 0.35Ω PMOSFET</li> </ul>	SOT-23-6
<a href="#">RT7272A</a> <a href="#">RT7272B</a>	4.5V	36V	0.8V-30V	3A	500kHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• <a href="#">RT7272A</a>: Force PWM</li> <li>• <a href="#">RT7272B</a>: PSM</li> <li>• Adj. current limit</li> <li>• Ext. compensation</li> <li>• Ideal for generic medium current supply</li> </ul>	PSOP-8
<a href="#">RT2862A</a> Richtek Designer™	4.5V	36V	0.8V-30V	3A	300kHz-1MHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>• Ext. compensation</li> <li>• Ideal for generic medium current supply</li> </ul>	PSOP-8

Buck Converters								
Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub> range	I <sub>OUT</sub>	f <sub>sw</sub> range	(T <sub>A</sub> ) Ambient temp. range	Key features	Package
<a href="#">RT2808A</a>	5.5V	36V	1.222V-26V	3A	500kHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>Asynchronous</li> <li>Internal compensation</li> </ul>	PSOP-8
<a href="#">RT2805A</a>	5.5V	36V	1.222V-26V	5A	500kHz	-40°C to 85°C		PSOP-8
<a href="#">RT8279</a>	5.5V	36V	1.222V-26V	5A	500kHz	-40°C to 85°C		PSOP-8
<a href="#">RT6266</a>	7.5V	36V	V <sub>FB</sub> = 0.8V	2.4A	100kHz	-40°C to 85°C	<ul style="list-style-type: none"> <li>Asynchronous</li> <li>Adj. load line compensation to compensate for voltage drop in a USB cable</li> <li>Adj. current limit</li> <li>Ideal for 5V USB/Cigarette lighter output</li> </ul> 	PSOP-8
<a href="#">RT6268</a>	7V	36V	V <sub>FB</sub> = 0.8V	3.7A	100kHz	-40°C to 85°C		PSOP-8

### Powering microcontrollers from industrial supply rails



#### Reference Designs:

- [RT6208](#) 3.3V/0.1A supply for MCU
- Voltage step-down using [RT9058/RT9069/RT9068](#) from 24V rails for powering MCUs
- Voltage step-down using [RT6200](#) from 24V rails for powering a 3.3V/500mA MCU
- Voltage step-down using [RT6206](#) to supply a 3.3V/50mA MCU.



LDO									
Part number	V <sub>IN</sub> (Min)	V <sub>IN</sub> (Max)	V <sub>OUT</sub>	I <sub>OUT</sub>	Dropout	(T <sub>A</sub> ) Ambient temp. range	Key features	Package	Family Products
<b>RT2558</b>	3.5V	36V	2.5V, 3.3V, 5V, 12V(fixed)	100mA	0.55V@10mA	-40°C to 85°C	<ul style="list-style-type: none"> <li>• 2µA ultra-low I<sub>Q</sub></li> </ul>	SOP-8	<a href="#">RT9058</a> (commercial) <a href="#">RT2560Q</a> (automotive)
<a href="#">RT9069</a>	3.5V	36V	2.5V, 3V, 3.3V, 5V, 9V, 12V(fixed)	200mA	0.2V@10mA	-40°C to 85°C	<ul style="list-style-type: none"> <li>• 2µA ultra-low I<sub>Q</sub></li> </ul>	PSOP-8, SOT-23-5, SOT-89-5, UDFN-6L 1.6x1.6	
<b>RT2571</b>	4.5V	60V	2.5V, 3.3V, 5V(fixed) 1.25V-60V(adj.)	50mA	0.25V@50mA	-40°C to 85°C	<ul style="list-style-type: none"> <li>• 30µA I<sub>Q</sub></li> <li>• <b>Reverse battery protection</b></li> <li>• Reverse in-out protection</li> </ul>	SOT-223, MSOP-8, SOP-8	<a href="#">RT9068</a> (commercial)
<b>RT2064</b>	4.5V	60V		100mA	0.5V@100mA	-40°C to 85°C		PSOP-8	<a href="#">RT9074</a> (commercial)
<b>RT2572</b>	4.5V	80V		20mA	0.18V@20mA	25°C		SOT-23-5	<a href="#">RT9072A/B</a> (commercial)

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