

***Automotive
LED Lighting
Component Guideline***

2017



**Your Right Choice for Automotive Front / Rear,
Interior, Turn Signal, and Brake LED Lighting**

The Overview of PANJIT's Automotive Grade Products



PANJIT International is a public company founded in May 1986. PANJIT is the manufacturer of rectifier diodes, power semiconductors, surge suppressors and other discrete components with more than 30 years of experience. PANJIT is committed to developing automotive-grade products for automotive applications and provides first-class quality products for the automotive market. Moreover, we implement the quality program of automotive industry to our product line in order to ensure that our processes of manufacture and quality control can meet the needs of automotive industry's reliability and durability. For the quality of automotive-grade products, PANJIT has a series of process plans abided by the principle of Zero Defect; which covers the strict checks of product design, quality certification, manufacturing and testing in order to continuously improve PANJIT's technology and capacity.

Our products meet the following automotive grade requirements:

Product Design

Steady design:

- Product design follow the APQP process, obey the automotive level design rule, and implement DFMEA / PFMEA potential risk assessment. It can be ensured to meet the demand of automotive high reliability requirements from the process of product manufacturing to packaging testing through steady design.

Manufacturing Management

Steady process manufacturing:

- Conform to TS16949 quality management system operation to build a comprehensive customer-oriented process in order to meet automotive customers' needs of quality.
- Refer to AEC-Q001 & AEC-Q002 specification, the PAT (Parts Average Test), SYL (Statistical Yield Limit) and SBL (Statistical Box Limit) are used to detect and analyze to ensure the quality and reliability of products. Pre-screening and removal of outliers and abnormal batches in order to achieve reliable product quality.

Quality Certification

AEC-Q101 certification:

- Automotive grade products are certified by the AEC-Q101 standard.
- Regularly verify the Automotive Product Reliability Test (Stress Test) for annual plan.
- Submit the complete PPAP according to customer requirements.

Continuous improvement

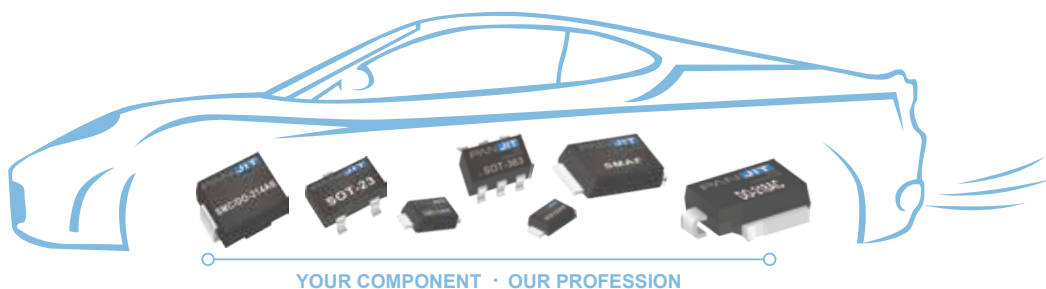
We will monitor the raw material and product manufacturing process and establish the capability of product data analysis, environmental stress test, problem solving techniques and failure analysis to continuously improve for achieving the goal of Zero Defect.



For automotive applications, PANJIT's product categories which are conformed to AEC-Q101 level in order to provide options for automotive applications:

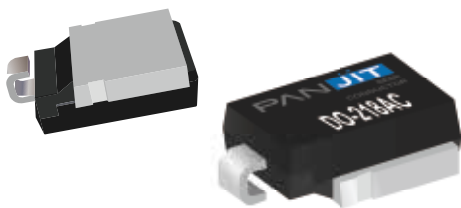
Product	Categories	Rating	Voltage
Schottky	Small Signal Schottky Diodes	0.1A-0.5A	30V-70V
	Power Schottky Rectifiers	1A-5A	20V-150V
SiC Power Device	SiC-Schottky Barrier Diode	2A-10A	650V
Diodes Rectifier	Small Signal Switching Diodes	0.2W-0.5W	80V-250V
	General Purpose Rectifiers	1A-8A	50V-1000V
	Fast Recovery Rectifiers	1A-2A	50V-1000V
	Ultra Fast Recovery Rectifiers	1A	100V-1000V
	Super Fast Recovery Rectifiers	1A-3A	50V-600V
Zener	Zener Diodes	0.2W-3W	2.4V-75V
Protection	ESD Arrays	0.6pF-540pF	3V-70V
	Transient Voltage Suppressors	0.2kW-6.6kW	3.3V-220V
MOSFET	Low Voltage MOSFET	0.5A-42A	20V-50V
BJT	Small Signal Bipolar Junction Transistors	0.15W-0.38W	30V-300V

All data subject to change. Please check our data sheets at www.panjit.com for updates.



TVS for Automotive Electronic Protection - DO-218AC

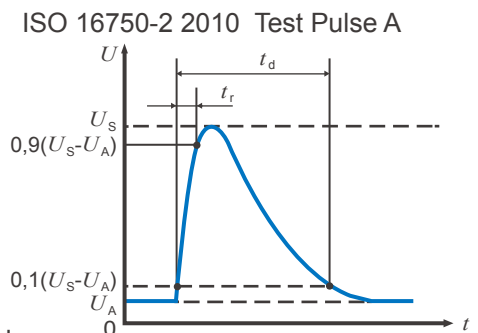
Load Dump TVS Series for 12V and 24V Powertrains for Automotive Electronic Protection



- High surge capability
- High current capability
- Low clamping voltage
- Low leakage current
- Meets ISO 16750-2 surge specification
- AEC-Q101 qualified

The series of ISO16750-2010(E) is a reliability verification standard and electronic voltage tolerance specification for automotive electronics.

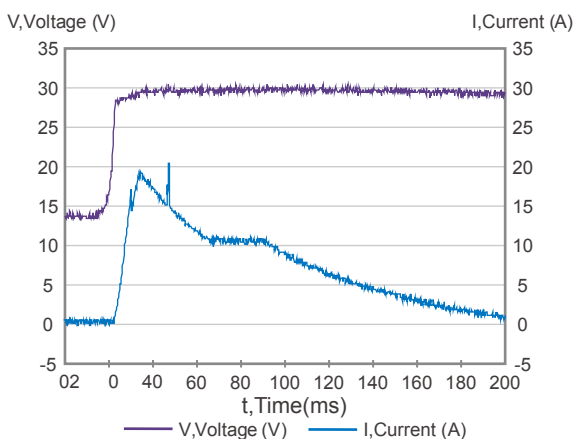
Parameter	Type of System		Mini. Test Requirement
	U _N =12V	U _N =24V	
U _s (V)	79 ≤ U _s ≤ 101	151 ≤ U _s ≤ 202	10 Pulses at intervals of 1min
R _i (Ω)	0.5 ≤ R _i ≤ 4	1 ≤ R _i ≤ 8	
t _d (ms)	40 ≤ t _d ≤ 400	100 ≤ t _d ≤ 350	
t _r (ms)	10 (+0/-5)	10 (+0/-5)	



- New test condition for Non-Central Load Dump Type Alternator Equipped Vehicles
- Replace ISO 7637-2 Pulse 5a
- Requires High Power load Dump Protection Device For Clamping Large Current
- Clamping Current is as: $I_{clamping} = (U_s - V_{clamping}) / R_i$

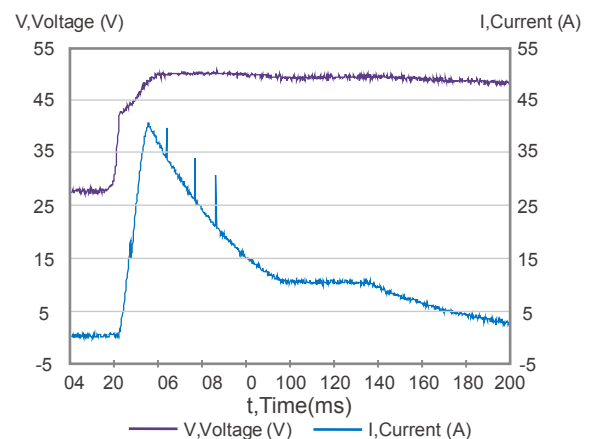
6.6KSMJX24A

Test Rule: ISO 16750-2 Test A / Ri=3Ω for 12V Powertrain



6.6KSMJX36A

Test Rule: ISO 16750-2 Test A / Ri=3Ω for 24V Powertrain



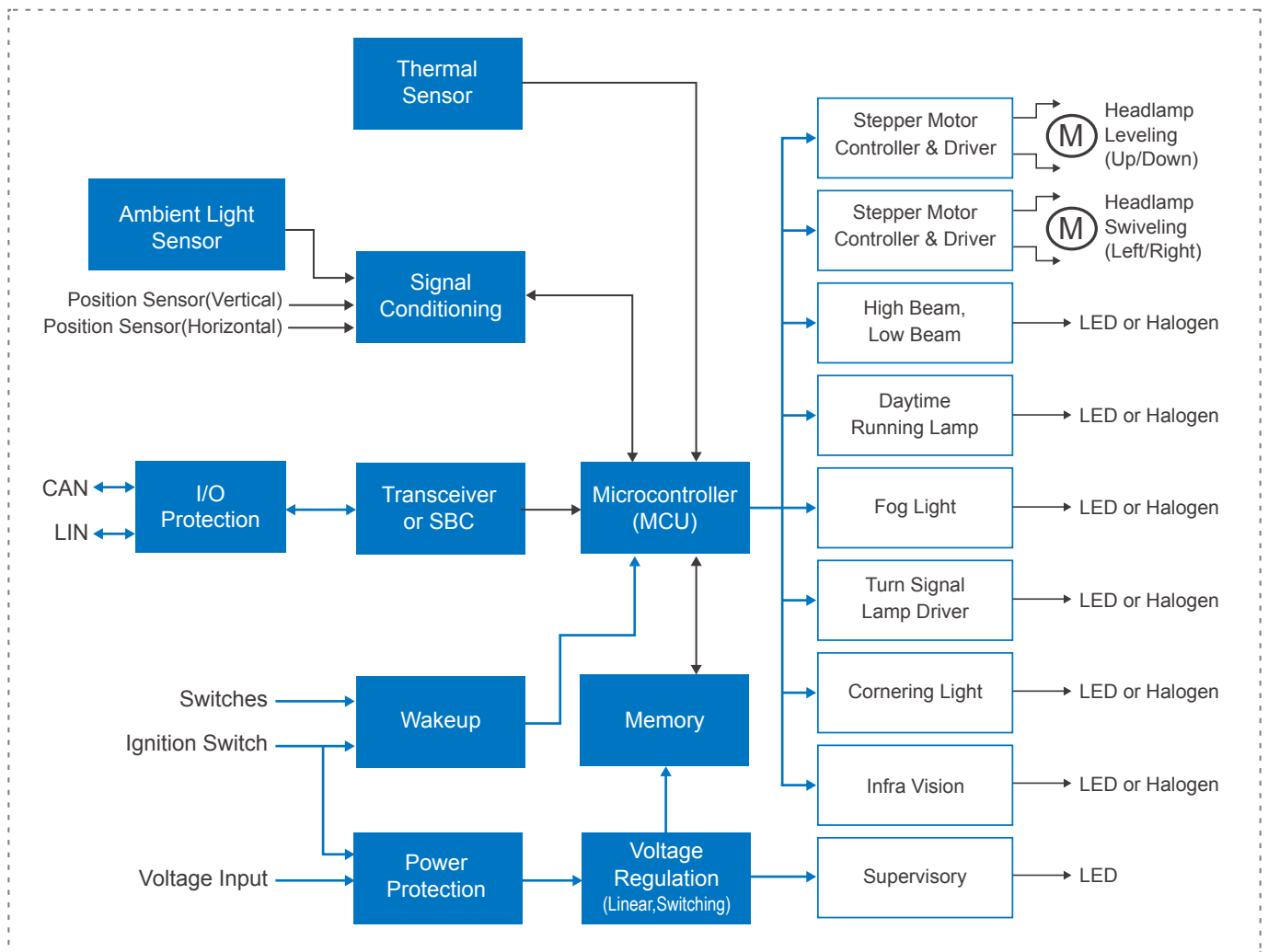
Automotive Front Lighting System Diagram



Nowadays, LED lighting has already replaced the traditional light bulbs as the design of light source in the automotive market. LED lighting is close to natural light, the two kinds of lights such as halogen and HID lights can't be compared with the performance of LED lighting. The performance of 1000W halogen light is approximately equal to 200W LED light, and LED light's life time can be over 30000 hours, which is ten times than HID light.

Due to LED lighting has varieties of excellent features such as low power consumption, long life, high flexibility and environmental protection, which is widely used in a variety of lighting systems gradually. Therefore, LED lighting has become the main choice for lighting design.

The exterior light for the car contains the front and rear lighting, and the front lighting contains low beam, high beam, daytime running lights, fog lights, turn signal lights, and so on. With more and more front lighting using LED lighting, PANJIT provides a complete product line in order to meet the demands of automotive front LED lighting.

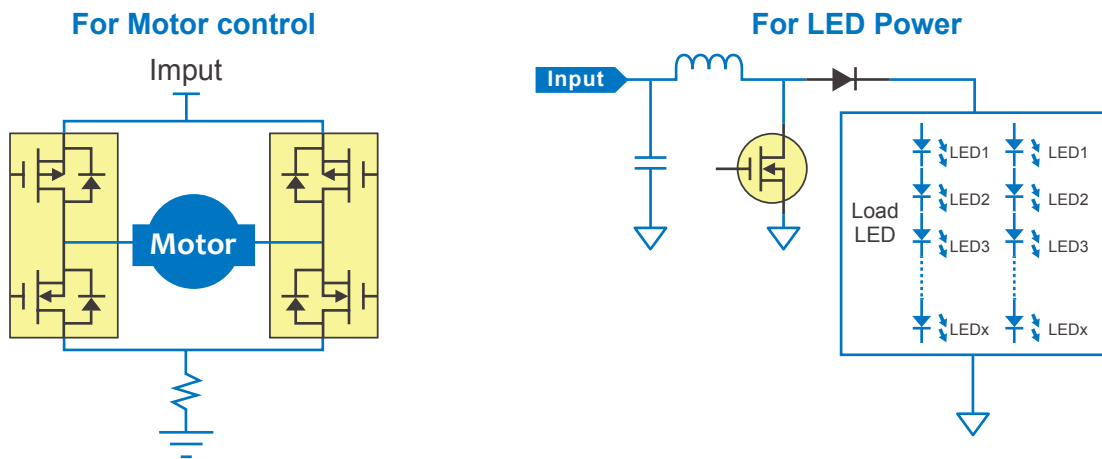


Automotive Front Lighting Control System



The front lighting control system includes dynamic headlamps, small lights, daytime running lamps, fog lights and other control system frameworks.

For the front lighting control system of high power consumption and high complexity, PANJIT currently develops product categories with the N/P MOSFET of 60V-100V/80A above, and the Schottky of 60V-100V/1A-12A. These devices deliver the features of high performance due to efficient heat dissipation of package design. Moreover, all devices are also compliant with AEC-Q101 qualification.



Application	Function	Part Number	Package	Spec	
Powetrain	MOSFET	PJL94xx series*	SOP-8	60V-100V / N or P MOS	
		PJPxxNxx series*	TO-220AB	60V-100V / N MOS	
		PJPxxNxx series*	TO-251	60V-100V / N or P MOS	
		PJPxxNxx series*	TO-252		
		PJQ54xx series*	DFN5060-8L		
	Schottky	SS1060xx-AU series		SOD-323HE	60V / 1A
				SOD-123HE	
				SOD-123FL	
		SS2060FL-AU		SOD-123FL	60V / 2A
		SSM3060VHE-AU		SOD-123HE	60V / 3A
		SXM36VF-AU	SMAF		60V / 3A
		SX56F-AU		60V / 5A	
	SVTxx100-AU		TO-277	100V / 8-12A	
TVS			DO-218AC	3.6KSMJXxxA-AU series	
				4.6KSMJXxxA-AU series	
				6.6KSMJXxxA-AU series	

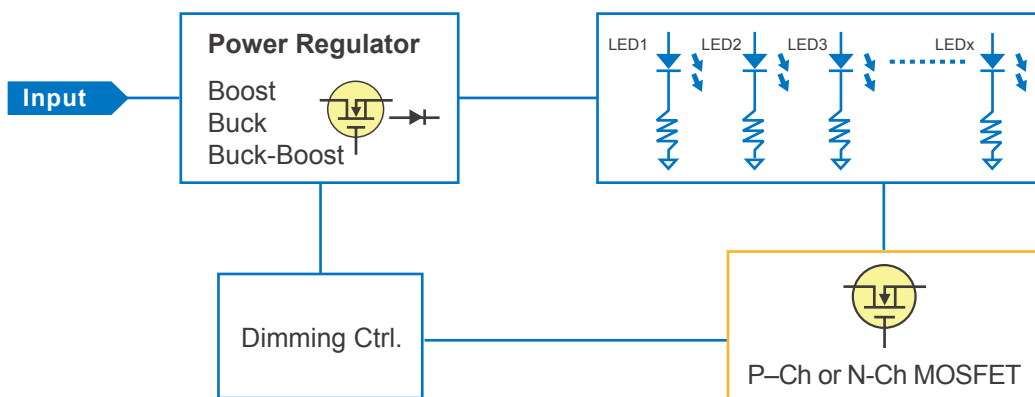
* Scheduling for AEC-Q101 qualification.

Automotive Interior Lighting Control System



The car interior lighting control system includes instrument panel lights, reading light, welcome light, gear shift indication, and other control system frameworks.

For having both the functional and aesthetic interior lighting control system, PANJIT provides product categories with 20-100V N/P MOSFET and 60V/1A-5A Schottky, which are small and flat package design. Moreover, they also have the superiority of market price competition and provide designers with an optimized choice in circuit design.



Application	Function	Part Number	Package	Spec
Dimming Control	MOSFET	PJA34xx series*	SOT-23	20V-100V / N or P MOS
		PJS64xx series*	SOT-23 6L	20V-30V / N or P MOS
Powertrain	MOSFET	PJL94xx series*	SOP-8	60V-100V / N or P MOS
		PJQ54xx series*	DFN5060-8L	60V-100V / N or P MOS
	Schottky	SS1060xx-AU series	SOD-323HE	60V / 1A
			SOD-123HE	
			SOD-123FL	
	Schottky	SS2060FL-AU	SOD-123FL	60V / 2A
		SSM3060VHE-AU	SOD-123HE	60V / 3A
		SXM36VF-AU	SMAF	60V / 3A
		SX56F-AU		60V / 5A
	TVS	3.6KSMJXxxA-AU series	DO-218AC	3.6kW-6.6kW
4.6KSMJXxxA-AU series				
6.6KSMJXxxA-AU series				

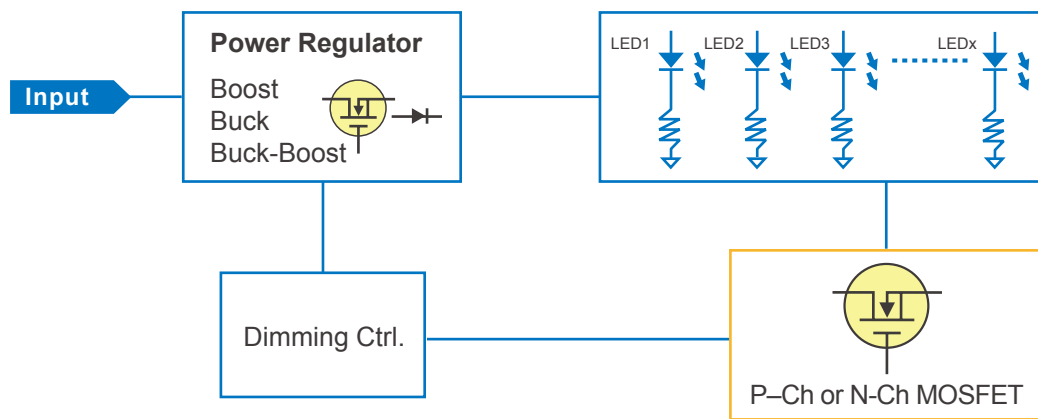
* Scheduling for AEC-Q101 qualification.

Automotive Rear Lighting Control System



The car rear lighting control system includes stop indication, position indication, fog lights, turn indicator and other control system frameworks.

For medium power requirements and low complexity rear lighting control system, PANJIT also provides the product categories with 20-100V N/P MOSFET and 60V/1A-5A Schottky, which are miniaturized package design. What is more, we offer a variety of package options and have the market price competitiveness in order to meet the demands of market.



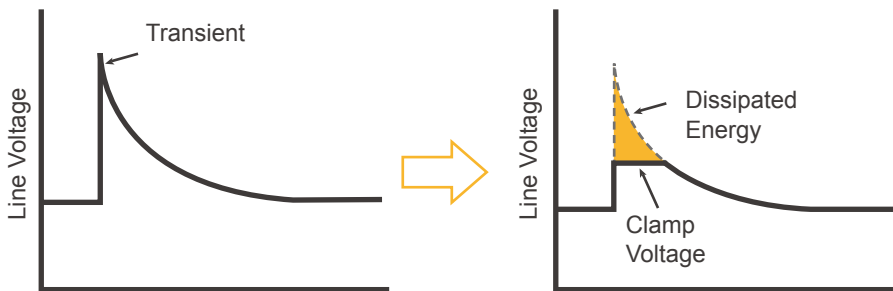
Application	Function	Part Number	Package	Spec
Dimming Control	MOSFET	PJA34xx series*	SOT-23	20V-100V / N or P MOS
		PJS64xx series*	SOT-23 6L	20V-30V / N or P MOS
Powertrain	MOSFET	PJL94xx series*	SOP-8	60V-100V / N or P MOS
		PJQ54xx series*	DFN5060-8L	
		PJDxxPxx series*	TO-252	60V-100V / P MOS
		PJDxxNxx series*		60V-100V / N MOS
	Schottky	SS1060xx-AU series	SOD-323HE	60V / 1A
			SOD-123HE	
			SOD-123FL	
		SS2060FL-AU	SOD-123FL	60V / 2A
		SSM3060VHE-AU	SOD-123HE	60V / 3A
		SXM36VF-AU	SMAF	60V / 3A
SX56F-AU	SMAF	60V / 5A		
TVS	3.6KSMJXxxA-AU series	DO-218AC	3.6kW-6.6kW	
				4.6KSMJXxxA-AU series
				6.6KSMJXxxA-AU series

* Scheduling for AEC-Q101 qualification.

I/O Port & Protection



It will produce surges when the engine starts; therefore, the role of TVS is used to suppress surge phenomenon caused by engine. PANJIT's TVS/ESD provide the features of short response time, low clamping voltage, low capacitance, high ESD robustness, effective surge protection, and small package, which improve comprehensive surge and static protection in order to prevent the engine from causing damages by the surge when it starts up. PANJIT provides a wide range of packages and electrical specifications for protection component products to meet the demands of I / O ports and power supply protection applications.



Load dump TVS clamps the surge voltage and by-passes the energy through the device to protect vulnerable electronic circuits.

Function	Part Number	Package	Spec
ESD	PJSOT36-AU	SOT-23	36V / 500W
	PEC3124C2A-AU	SOT-23	24V / ±18KV
	PJEC12VM1TA-AU	SOT-23	12V / ±30KV
Zener	AZ23Cxx-AU series	SOT-23	2.4V-36V / 0.3W
	BZT52-CxxS-AU series	SOD-323	2.4V-75V / 0.2W
	BZX84CxxxTW-AU series	SOT-363	2.4V-75V / 0.2W
	BZX84C3V3-AU series	SOT-23	2.4V-75V / 0.41W
TVS	P4SMAFJxxA series*	SMAF	3.3V-170V / 400W
	P6SMBJxxA/CA-AU series	SMB	5V-220V / 600W
	1.5SMCJxxA/CA-AU series	SMC	5V-220V / 1500W
	3.0SMCJxxA/CA-AU series	SMC	5V-220V / 3000W
	5.0SMCJxxA-AU series	SMC	20V-250V / 5000W
	3.6KSMJXxxA-AU series	DO-218AC	3.6kW-6.6kW
	4.6KSMJXxxA-AU series		
6.6KSMJXxxA-AU series			

* Scheduling for AEC-Q101 qualification.

PANJIT



PANJIT 強茂股份有限公司
SEMI CONDUCTOR PANJIT International Inc.

For more information on PANJIT products and solutions,
please visit : www.panjit.com