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君耀电子
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12V/24V Nominal Voltage Automotive Electrical System

Overvoltage Transient Suppressors

ATH/SMEJ Series Product White Paper

(Version: B1)

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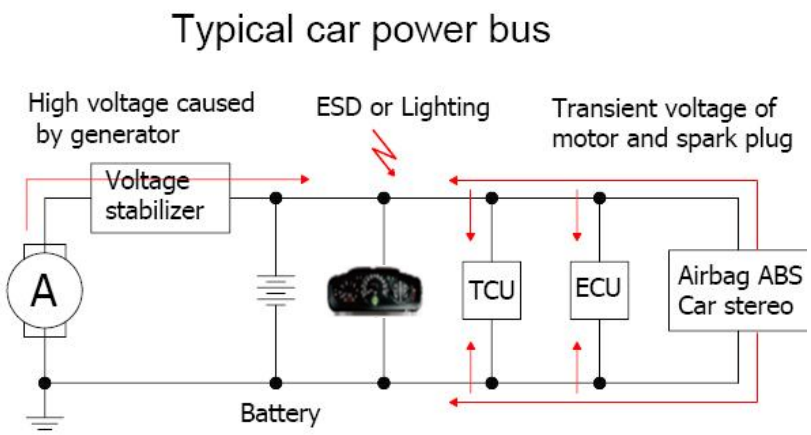
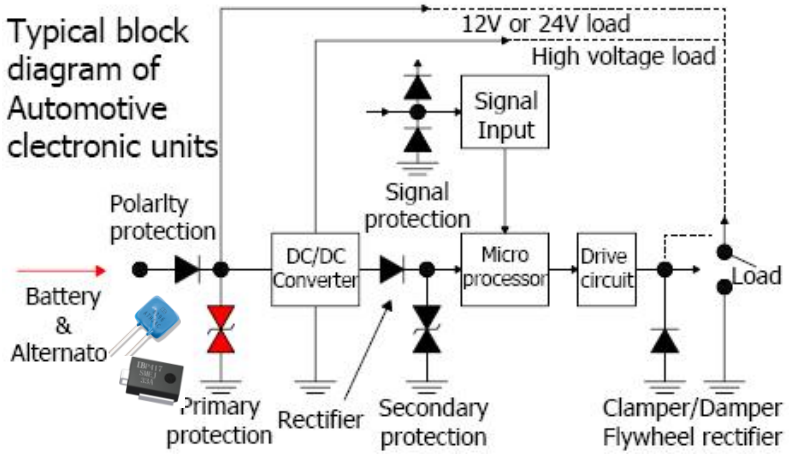
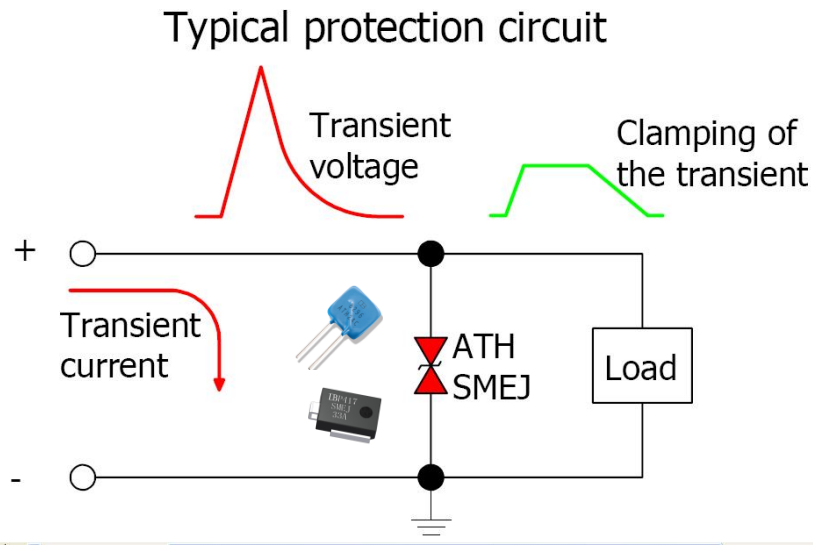
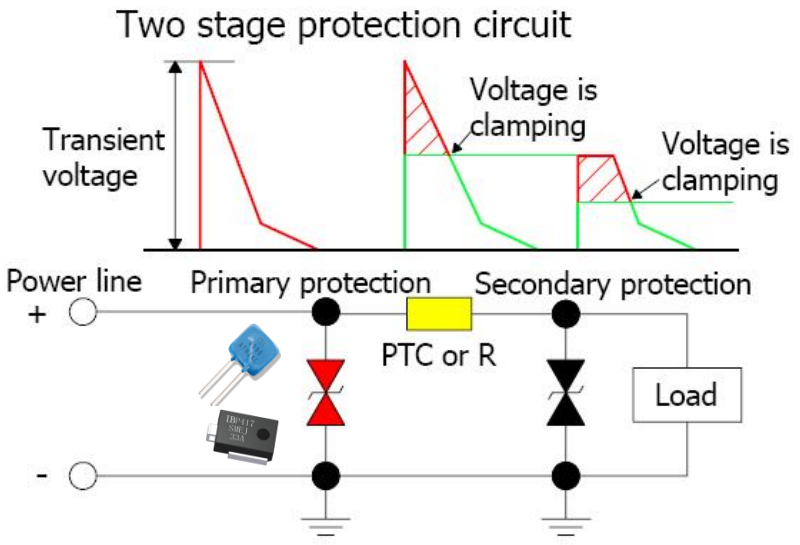
Applications

Widely used in automotive electronic products to protect the primary side of the power electronic devices, including automotive information systems (onboard computer), tire pressure monitoring systems, navigation systems, audio-visual entertainment systems, automotive networks, car DVD, electronic rearview mirror, car theft radar, anti-theft alarm, auto air conditioning, driving recorder and so on.







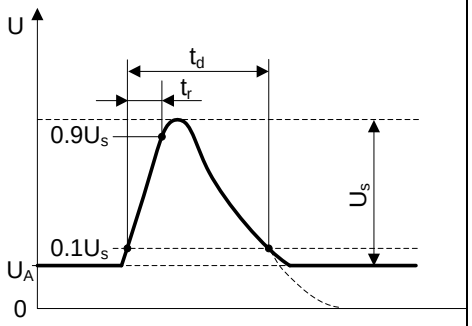
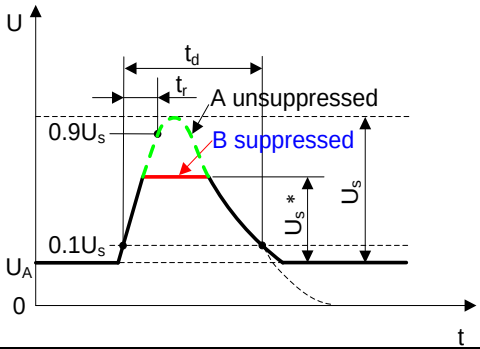


Test Standard Information

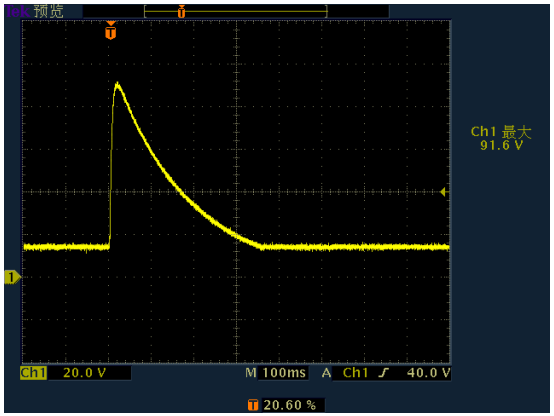
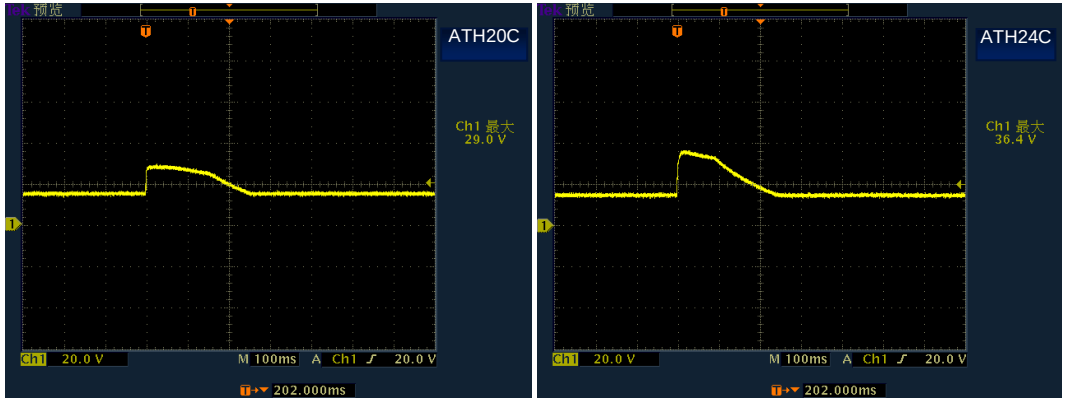
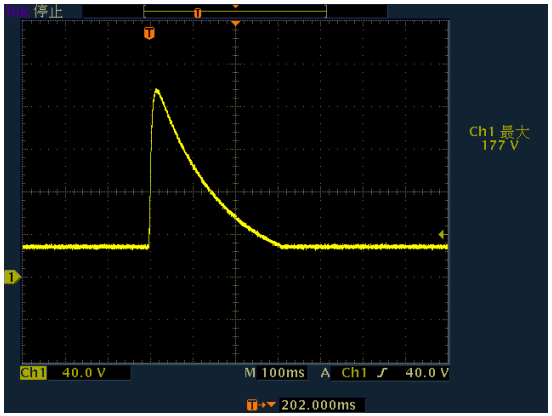
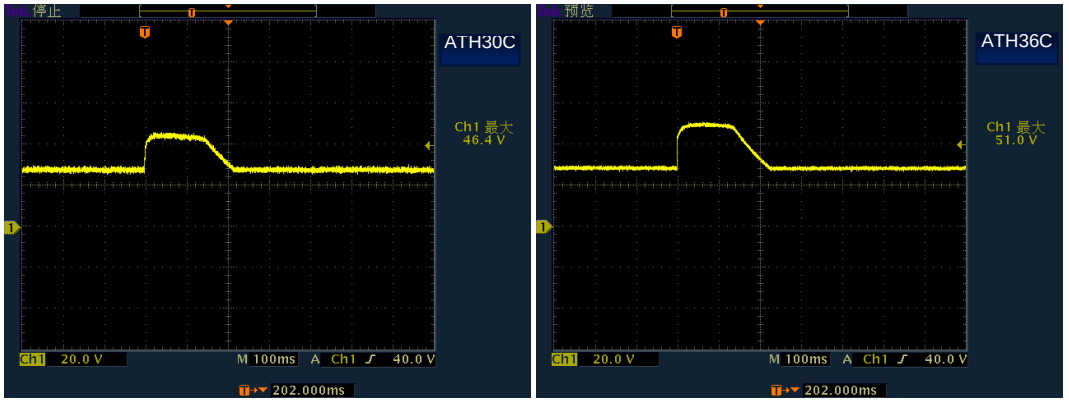
This test is a simulation of load dump transient, occurring in the event of a discharged battery being disconnected while the alternator is generating charging current and with other loads remaining on the alternator circuit at this moment; the load dump amplitude depends on the alternator speed and on the level of the alternator field excitation at the moment the battery is disconnected. The load dump pulse duration depends essentially on the time constant of the field excitation circuit and on the pulse amplitude, please referring to the ISO 7637-2 2004 Annex F. In most new alternators, the load dump amplitude is suppressed and clamped by the addition of the voltage limiting diodes.

Load dump may occur on account of a battery being disconnected as a result of cable corrosion, poor connection or of intentional disconnection with the engine running.

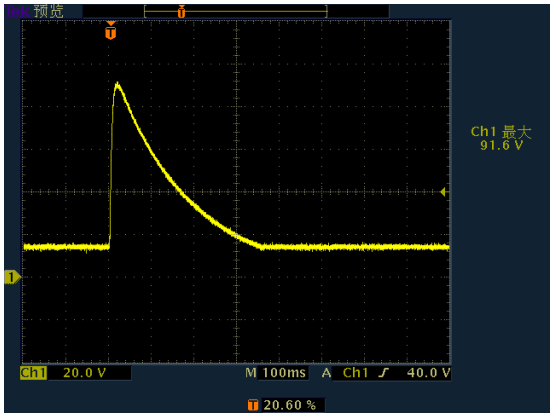
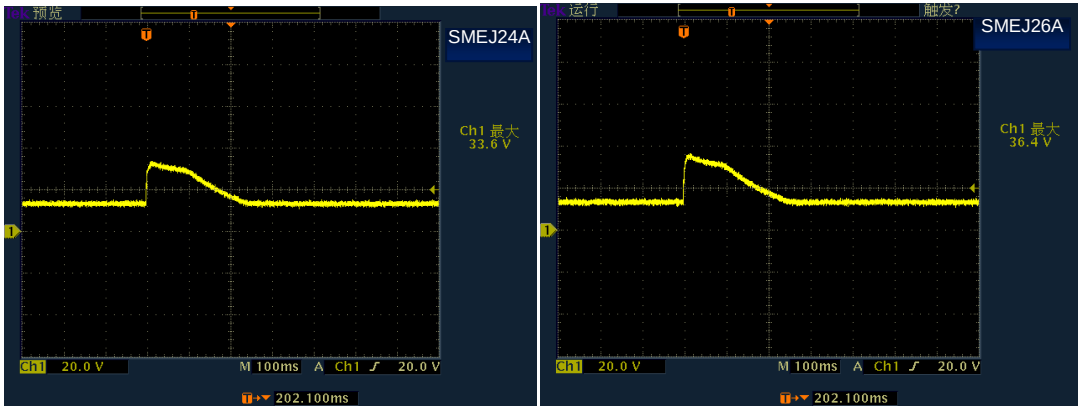
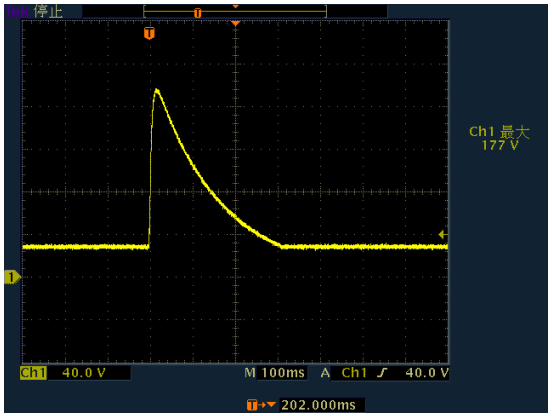
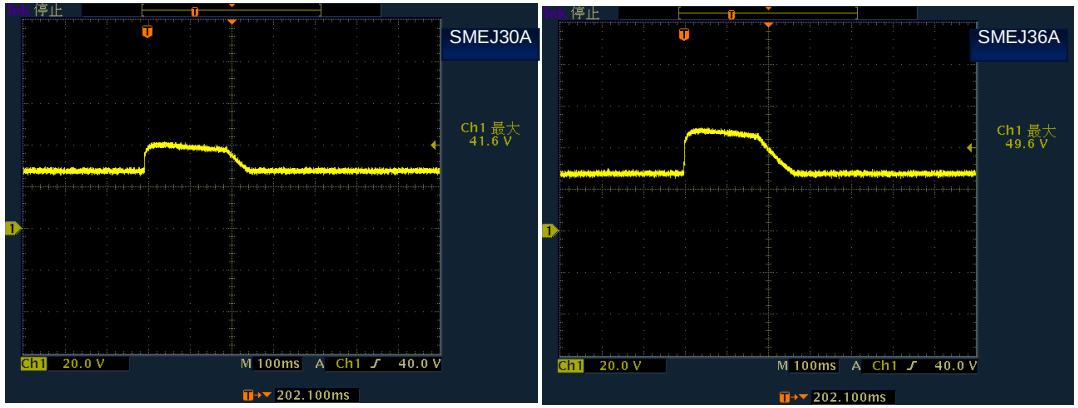
The pulse shape and parameters for an alternator with no centralized load dump suppression pulse 5a) are shown in Figure 1 and Table A. The pulse shape and parameters for an alternator with centralized load dump suppression pulse 5b) are shown in Figure 2 and Table A.

<table>
<tr><th colspan="4">ISO 7637-2 2004(E)</th></tr>
<tr><th colspan="3">Table A</th><th rowspan="2">(Pulse 5a)
without centralized load dump suppression</th><th rowspan="2">(Pulse 5b)
with centralized load dump suppression</th></tr>
<tr><th>Parameter</th><th>12V system</th><th>24V system</th></tr>
<tr><td>Us</td><td>65V to 87V</td><td>123V to 174V</td><td rowspan="6"> 
</td><td rowspan="6"> 
</td></tr>
<tr><td>Us *</td><td colspan="2">As specified by customer</td></tr>
<tr><td>Ri</td><td>0.5Ω to 4Ω</td><td>1Ω to 8Ω</td></tr>
<tr><td>td</td><td>40ms to 400ms</td><td>100ms to 350ms</td></tr>
<tr><td>tr</td><td colspan="2">$(10\ ^{0}_{-5})$ ms</td></tr>
<tr><td>Note</td><td colspan="2">Pulse waveforms are shown on Figure 1, Figure 2.</td></tr>
<tr><td colspan="3"></td><td>Figure1</td><td>Figure2</td></tr>
</table>

ATH Product Test Results

ISO 7637-2 2004 12V system 87V 0.5Ω 400mS original pulse waveform	Overvoltage transient suppressors(ATH20C/ATH24C) clamped pulse waveform
	
ISO 7637-2 2004 24V system 174V 2Ω 350mS original pulse waveform	Overvoltage transient suppressors(ATH30CA/ATH36CA) clamped pulse waveform
	

SMEJ Product Test Results

ISO 7637-2 2004 12V system 87V 1Ω 400mS original pulse waveform	Overvoltage transient suppressors(SMEJ24A/SMEJ26A) clamped pulse waveform
	
ISO 7637-2 2004 24V system 174V 4Ω 350mS original pulse waveform	Overvoltage transient suppressors(SMEJ30A/SMEJ36A) clamped pulse waveform
	

ATH/SMEJ Electrical Characteristics (T_A=25℃ unless otherwise noted)

Part Number (Bi)	Breakdown Voltage @I_T		Test Current	Reverse Stand-Off Voltage	Reverse Leakage@ V_{RWM}	Maximum Clamping Voltage @IPP	Peak Pulse Current
	$V_{br\ Min.}$(V)	$V_{br\ Max.}$(V)	I_T (mA)	V_{RWM}(V)	I_r (μA)	Vc(V)	Ipp(A)
ATH16C	17.0	20.0	5.0	16.0	10.0	28.0	540
ATH20C	21.0	25.0	5.0	20.0	10.0	34.0	450
ATH24C	25.0	30.0	5.0	24.0	10.0	40.0	400
ATH30C	33.0	38.0	5.0	30.0	10.0	51.0	350
ATH36C	38.0	45.0	5.0	36.0	10.0	59.0	300
SMEJ20A	22.2	24.5	5.0	20.0	10.0	33.4	245.0
SMEJ22A	24.4	26.9	5.0	22.0	10.0	36.6	222.5
SMEJ24A	26.7	29.5	5.0	24.0	10.0	40.1	202.5
SMEJ26A	28.9	31.9	5.0	26.0	10.0	43.4	186.3
SMEJ28A	31.1	34.4	5.0	28.0	10.0	46.8	171.3
SMEJ30A	33.3	36.8	5.0	30.0	10.0	50.1	160.0
SMEJ33A	36.7	40.6	5.0	33.0	10.0	55.2	145.0
SMEJ36A	40.0	44.2	5.0	36.0	10.0	60.4	132.5
SMEJ40A	44.4	49.1	5.0	40.0	10.0	68.3	117.5
SMEJ43A	47.8	52.8	5.0	43.0	10.0	73.8	108.9
SMEJ48A	53.2	58.7	5.0	48.0	10.0	85.6	93.5

Part Number (Bi)	Suitable ISO 7637-2 2004 5a test waveform						
	Voltage Level		Resistance Level				
	87V 400mS	174V 350mS	0.5Ω	1Ω	2Ω	4Ω	8Ω
ATH16C	X		×	×	×	×	×
ATH20C	X		×	×	×	×	×
ATH24C	X		×	×	×	×	×
ATH30C		X			×	×	×
ATH36C		X			×	×	×
SMEJ20A	X		×	×	×	×	×
SMEJ24A	X			×	×	×	×
SMEJ26A	X			×	×	×	×
SMEJ28A	X				×	×	×
SMEJ30A		X				×	×
SMEJ33A		X				×	×
SMEJ36A		X				×	×
SMEJ40A		X				×	×
SMEJ43A		X				×	×
SMEJ48A		X				×	×

Note: 1. ‘x’ representatives meets this test condition;

2. Other information, please refer to product technology specifications

Benchmarking

Product Type	Package Type	Reverse Stand-Off Voltage	ISO7637 P5a test passed level							
			12V system				24V system			
			87V/400ms				174V/350ms			
			4Ω	2Ω	1Ω	0.5Ω	8Ω	4Ω	2Ω	1Ω
ATH	DIP	24V	×	×	×	×				
5KP	P-600	24V	×	×						
15KPA	P-600	24V	×	×	×					
20KPA	P-600	24V	×	×	×	×				
30KPA	P-600	28V	×	×	×	×				
SMEJ	DO-218AB	24V	×	×	×					
HFA	DIP	25V	×	×	×	×				
ATH	DIP	36V					×	×	×	
5KP	P-600	36V					×			
15KPA	P-600	36V					×	×		
20KPA	P-600	30~36V					×	×		
30KPA	P-600	30~43V					×	×		
SMEJ	Do-218AB	30~43V					×	×		
HFA	DIP	30~36V					×	×		